The Humanizing of the Brute

H. MUCKERMANN, S. J.

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The Humanizing of the Brute

OR

The Essential Difference between the Human and Animal Soul proved from their Specific Activities

BY

H. MUCKERMANN, S. J.

WITH FIVE PLATES

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To

THE REV. ERIC WASMANN, S. J.,

this little volume

is

gratefully dedicated.

"*Und was man ist,*
das blieb man andern schuldig."
—*Goethe.*

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NOTE:—The author is indebted to the Rev. Fr. John J. Wynne, S. J., Editor of the Messenger, and to the Editor of the Scientific American for their kind permission to make use of several papers which originally appeared in their periodicals.

Chapter I.

The Humanizing of the Brute.

IT is a well-known fact that in the homes of the "upper ten thousand" special servants in charge of animal pets play an important part. It is the interesting duty of these favored mortals to rouse the lovely poodles, pugs, and pussies from pleasant slumbers, to attend to their toilet and attire, to take them out for a drive on bright and sunny days, or lead them a-promenading down a cool and shady avenue, and, last not least, to dance humble attendance upon their charges when feasting at a lordly and luxurious table. Houses of refuge and asylums for orphaned cats have been erected at Berlin, and it was reported from Paris that at the time of the last exposition a cemetery for dogs, cats, birds, and other domestic animals had been opened. This city of the dead, with its resplendent monuments in honor of the noble departed, is said to rival a fairy-palace in beauty. Indeed, as J. G. Holland expresses his sentiments in very pathetic terms to his "dear dog Blanco:"

"I look into your great, brown eyes,
Where love and loyal homage shine,
And wonder where the difference lies
Between your soul and mine. . . . .

I clasp your head upon my breast—
The while you whine and lick my hand—
And thus our friendship is confessed
And thus we understand.
Ah, Blanco! Did I worship God
As truly as you worship me,
Or follow where my Master trod
With your humility:
Did I sit fondly at his feet
As you dear Blanco sit at mine,
And watch him with a love as sweet,
My life would grow divine."

These few but telling facts furnish a striking illustration of the senseless mania of regarding the animal as a brother of man, his equal in nature and essence. Indeed, the intelligence of animals is almost universally defended by modern naturalists. Some of them, as Buechner, Eimer, Marshall, and a host of others, whom Prof. W. M. Wheeler justly styles "popularizers," ascribe even to animals as low as ants a high degree of mental activity, in some respects superior to that of man. Others, as A. Bethe and Uexkuell, maintain that only the higher animals, such as dogs, are endowed with intelligence, whilst the lower ones, as for instance insects, are mere reflex machines, destitute of all psychic qualities. Others, finally, as Emery, Forel, Morgan, Romanes, Peckham and so forth, attribute intelligence to all animals without exception, but add that this intelligence, though not differing in quality from that of man, is infinitely *inferior* to it *in degree*. Only a few, such as Wasmann and Wundt, are convinced that there is no trace of true intelligence, either in the lower or in the higher animals. Prof. Wheeler seems to hold that there is no evidence of

ratiocination in animals. It is true, he ascribes what he calls "simple intelligence" to animals, and maintains that this term implies "choice on the part of the individual organism." [1]) But his term "choice" can hardly mean choice in as far as it supposes the abstract comparison of two objects. For he declares with reference to ants "that there are no evidences of anything resembling abstract thought, cognition or ratiocination as manifested in man." [2]) Prof. Edward L. Thorndike of Columbia University is a decided adversary of animal intelligence. After a most careful examination of the question, he "failed to find any act that even *seemed* due to reasoning," [3]) and that "even after leaving reason out of account, there are tremendous differences between man and the higher animals." [4])

But abstracting from such few authors the late zoologist Prof. A. S. Packard is correct when he states: "Those naturalists who observe most closely (?) and patiently the habits of animals do not hesitate to state their belief that animals, and some more than others, possess reasoning powers which differ in degree rather

[1]) "The Compound and Mixed Nests of American Ants," *The American Naturalist*, Vol. XXXV. (1901), p. 809.

[2]) l. c., p. 813.

[3]) "Animal Intelligence; an Experimental Study of the Associative Processes in Animals." Series of Monograph Supplements to *Psychological Review* Vol. II., No. 4, June, 1898, p. 46.

[4]) l. c., p. 87. Thorndike, at times, speaks of animals as if he ascribed intelligence to them. But, in reality, he means nothing else than what we would call "plastic instinct."

than in kind from the purely intellectual acts of man." [1])

Now upon investigation into the cause underlying this erroneous principle we might, as far as the more popular circles are concerned, discover one reason in the nervous sentimentalism of our days. At the beginning of the twentieth century, no less than towards the end of the eighteenth, people have become extremely sensitive to any sort of pain. Pain like a haunting spectre is dreaded with the utmost anxiety and avoided even to a nicety; and since the human heart is inclined to find some correspondence between external circumstances and its own apprehensions and emotions, it kindles in sympathy wherever pain is noticed, whether real or imaginary. This inclination will grow stronger as soon as there is question of animated beings that are attached to man and afford him sensuous pleasure, and leave upon him the impression of a certain helplessness. Of course, as is attested by daily experience, one of the first and foremost places among such cherished creatures must be assigned to the animals known as our "domestic companions." Besides there exists a certain analogy between the manifestations of pain in man and in the brute, between the expression of man's spiritual affections and the corresponding merely sensuous feelings indicated in the features of animals. Thus it happens that from the expression visible in the eye of a faithful dog the inference is drawn, not to an empty stomach, but rather to a heart oppressed by sorrow

[1]) A. S. Packard, M. D. Ph. D., Zoology (10th ed.) p. 680.

and even weariness of life. In other words, it is from sheer sentimentality that the spiritual affections proper to man alone are under similar circumstances attributed to animals; hence it follows that a genuine consciousness of pain, presupposing reason and intellect, is ascribed to them.

"Human folk," says Thorndike in his admirable monograph on animal intelligence, "are as a matter of fact eager to find intelligence in animals. They like to. And when the animal observed is a pet belonging to them or their friends, or when the story is one that has been told as a story to entertain, further implications are introduced." [1])

A second reason for this universal anthropomorphism is touched upon by Peckham when he speaks "of the futility of any attempt to understand the meaning of the actions of animals until one has become well acquainted with their life habits." [2]) Many animal actions, to all appearances, bear such traces of intelligence that they are almost involuntarily attributed to an intellectual principle. A more careful examination and comparison with other actions of the same animal will soon convince us of our error.

"Thousands of cats on thousands of occasions, sit helplessly yowling, and no one takes thought of it; but let one cat claw at the knob of a door, supposedly as a signal to be let out, and straightway this cat becomes the representative of the cat-mind in all the books.

[1]) Thorndike, l. c., p. 4.

[2]) G. W. Peckham and E. G. Peckham. On the Instincts and Habits of the Solitary Wasps, Madison, 1898, p. 230.

The unconscious distortion of the facts is almost harmless compared to the unconcious neglect of an animal's mental life until it verges on the unusual and marvellous.''[1])

The defective philosophical training and superficial education, so prevalent in our times, suggest a third reason for this mania of ascribing intelligence to animals. Ever since the destructive attempts of Kant and his disciples to shake and shatter the realms of ideas, the true object of philosophy is ignored and lost. The noble queen, the exalted offspring of eternal wisdom, has been stripped of her royal dignity; and while ruthless hands have snatched the crown from off her head, she has been degraded to be the cringing handmaid of experimental science. And what was the unavoidable result? That very soon the principles of the old and sound philosophy fell into contempt, whilst in their stead there rose a confusion and obscurity of ideas which oftentimes led to the defense of most obvious errors permeating certain branches of science. Thus our modern psychology, as upheld by many of its advocates, is a veritable monstrosity. Wundt can not refrain from blaming modern psychology for its ''premature application of notions insufficiently determined'' and for its ''ignorance of systematic psychological methods.'' Thus he explains the fact ''that the psychic processes of brutes are not taken for what they appear in immediate and unprejudiced observation, but that the observer's reflections are transferred to the animal. If any vital action has the appearance of possibly

[1]) Thorndike, l. c. p. 4.

being the result of a number of reasonings and conclusions, this is taken as a cogent proof that such reasoning and conclusion actually occurred. And thus all the psychic activity is resolved into logical reflections."[1])

The above mentioned reasons, however, do not offer us the final and fundamental explanation for the persistent tendency of assigning a difference between man and animal, not of kind but of degree.

The assumption of animal intelligence, as every other error, is essentially rooted in the will. It does not require much depth or breadth of intellect to see that the humanizing of the brute is a mere corollary of materialistic evolution. Materialism denies the existence of a vital principle apart from matter, and maintains that life is merely the resultant of attracting and repelling forces. Everything, therefore, is pure matter, and there can be no essential difference between the animal soul and that of man, since neither can exist independently of matter. But if there is no essential difference between the animating principles of man and brute, why assume any between the faculties and manifestations of these principles? In other words, if human actions are guided by intelligence, the same holds true for those of animals.

It follows that the theory of animal intelligence is the natural outcome of materialism, and as such must be traced back to the same source from which materialism ultimately springs. To speak plainly, the first promulgators of "animal intelligence"

[1]) W. Wundt, Vorlesungen ueber die Menschen=und Tierseele, 3. ed, 1897, p. 387.

and those "popularizers," as Wheeler justly calls them, who now uphold it with such tendentious tenacity often seem to have no other purpose in view than to establish a theoretical justification for descending practically to a level with the brute.

These reasons we believe clearly prove the deplorable character of this modern tendency which aims at leveling the difference between animal and man, a tendency which, because of its universality and the warm support it receives, calls for most strenuous opposition.

It is our intention to contribute in some small share to the controversy, and to prove in a simple and clear manner the essential difference which has ever been upheld by Catholic philosophy with reference to the souls of man and brute. Man and brute belong to two different realms of life, separated by a spanless chasm. This is the thesis we propose to the consideration of the reader, and in order to demonstrate it, we shall confine ourselves to the specific activities of man and brute, basing our entire argumentation on the following simple syllogism:

True instinct and intelligence [1]) *differ essentially. Now the brute possesses merely instinct and no trace of intelligence. Therefore man and brute differ essentially.*

In the first part of the essay we shall develop the concept of instinct, then explain the true

[1]) That is "rational intelligence." To avoid misunderstandings we may note here that by the term intelligence, we always mean intelligence in its proper signification, that is rational intelligence.

criterion which invariably separates instinct and intelligence, and prove that this criterion involves an essential difference. In the second part we shall make use of the criterion established and prove that there is no trace of intelligence in animals.

PART I.

INSTINCT AND INTELLIGENCE DIFFER ESSENTIALLY.

CHAPTER II.

Instinct and Final Tendency.

THE views of scientific men on the nature of instinct and instinctive activity are so widely divergent that any endeavor of securing general acceptance for a precise definition of the terms seems to be a hopeless task. Still it is necessary to make the attempt; for without clear definitions and premises it is impossible to treat a question fairly or to arrive at clear conclusions. The clear sky lies beyond the clouds and the haze of the atmosphere. What, then, do we understand by instinct? Sense experience or well observed facts, and not preconceived ideas, are to furnish the necessary data from which we determine the characteristics actually common to all instinctive activity. But in appealing to facts and common sense it is well to remain on neutral ground; we shall restrict our present investigation to actions that are not and cannot be modified by any experience and are acknowledged alike by friend and foe to belong to the category of instinctive activity. In this supposition we shall show first of all that all actions proceeding from instinct necessarily involve a final tendency.

It is obvious that the influence of "purpose," or a final tendency, is met with everywhere in the universe. The recognition of this truth is forcibly brought home to us by the study of the laws of inorganic matter in the wonderful cycle of carbon in the realm of nature, the numeric proportions according to which atoms combine and separate, the peculiar quality of water in reaching its maximum density at 4^0 C. It is clearly demonstrated by the laws of organic life in general, and especially by the study of the human body, its organs and functions, the eye, the heart, the circulation of the blood, the activity of brain and nerves. But nowhere is the recognition of final tendency demanded more emphatically than in the explanation of the activity of animals which originates in their instinctive faculties. Indeed, we meet with so many actions appropriate to specific ends that, if anywhere in nature, then surely in the domain of instinct, "final tendency" holds the sceptre of sovereignty.

Countless illustrations offered by natural history show that the tendency, which is characteristic of all instinctive activity, refers to the preservation of the individual animal and of its distinctive species. Consequently, there are three principal groups of instinctive actions: those which refer to the nutrition of the individual, those which tend to its defence, and those which are directed toward the propagation of the species. As it is impossible to investigate every instinctive action in detail, we shall confine our study to these three groups, and we shall find abundant evidence to prove that "final tendency" is an essential constituent of every activity that is acknowledged to belong to the realm of instinct.

In studying the first group of instinctive actions, those by which animals nourish themselves and their progeny, we are struck by two main facts: the peculiar fitness of the nourishment for the digestive organs of the animal and the appropriate manner in which it is procured. Let us take as an example the development of the beetle Sitaris humeralis (muralis), which has been so admirably described by the French naturalist Fabre. [1]) In its first larval stage this interesting blister-beetle of the family of the Meloidae cannot live except on the egg of a bee, whereas the indispensable food of the second stage is honey, which would have been virulent poison to the beetle in its earliest existence. The following organs are at the disposal of our beetle to secure possession of the egg: six strong legs, well adapted for climbing and clinging to other objects, fully developed mandibles and feelers, and finally good eyes. But after the transformation of the first larval stage into the second, the wormlike grub is blind and has almost lost its legs and feelers, but is endowed with a large mouth admirably adapted for sipping the honey which is necessary for its subsistence in this second stage of development. The spot where Sitaris first beholds the light of day is near the entrance of the bee's habitation. The larva is hatched toward the end of September or early in October, and remains quietly on the same spot throughout the winter without any food until the bee leaves its home in early spring. Then the moment for action has arrived, and it is highly interesting to observe how our beetle procures its suitable nourishment in the most appropriate manner.

[1]) J. H. Fabre, Nouveaux Souvenirs Entomologiques, Paris, 1882, Vol. II., p. 262.

When the male-bees are about to leave the nest they must necessarily pass the spot where our little larva has patiently lurked, as it were, for six months. Itseems to have anticipated this fact, and when the bee unsuspectingly approaches the entrance of the nest, the larva vaults with the greatest ease on the bee's back, and off it goes on an interesting journey through the beautiful realm of new-born spring. But at once it is confronted by a new difficulty; for it will never succeed in finding an egg on the back of the male-bee, especially as the latter never returns to the nest. Yet our little rider knows very well what to do. At the moment when the male-bee on his journey meets the female, the larva swaps horses, and having returned to the nest on the back of the female, slides along the drawn out abdomen directly onto the first egg she deposits in the carefully prepared cell. With the usual signs of satisfaction, the bee then closes the cell, in which the embryo bee and the bold intruder have been immured, and the larva can now consume the egg without fear of disturbance. Resting on the floating island of "eggshells," it passes into the second stage and then enjoys the sweet honey in perfect security from all danger for the following stages of its extraordinary metamorphosis.

Not less remarkable are those instinctive actions of animals by which they provide for their defence and propagation. But these actions must not be separated from the circumstances which influence their performance. Indeed, if these circumstances were always taken into consideration, no one would dare affirm that instinctive actions of animals are inappropriate in

their nature, though sometimes for the sake of a higher end they may fall short of their immediate purpose.

A classical example admirably adapted to illustrate the point at issue is the life-history of the famous leaf-roller Rhynchites betulæ L.; for in constructing the cradle for its young this tiny black snout-beetle has for ages been carrying out a problem which, at least in its entirety, was not known to man before the year 1673, when the great mathematical genius, Huygens, published his celebrated "Horologium Oscillatorium."

Let us give a brief account of the famous beetle and its problem, basing our remarks on the investigations and writings of Debay [1]) and of Wasmann [2]) and upon observations made by ourselves many years ago in Holland.

In early spring, as soon as the *Rh. betulæ* [3]) has emerged from the ground, it climbs up a birch-tree, where, after mating, the female at once proceeds to construct from the pliant young birch leaves a little house for her offspring. Carefully examining the edge of a leaf, the beetle suddenly stops and begins to cut the outlines of what is to be the cradle for its little ones. It starts at the upper margin of one side of the leaf. Directing its head toward the upper part of the central rib, it cuts with its admirably adapted mandibles an S-shaped curve, whose terminal touches the leaf's

[1]) Dr. Debay, Beitraege zur Entwicklungsgeschichte der Ruesselkaefer aus der Familie der Attelabiden, Bonn, 1846.

[2]) Erich Wasmann, S. J., Der Trichterwickler, Muenster, 1884. The following account was first published in the Scientific American, April, 1901.

[3]) From betula, birch-tree.

central rib. Then, after having made a slight incision into the main nerve of the leaf, in order to impair the flow of the sap, it cuts across the other half of the leaf a corresponding but more horizontal curve which terminates a little higher on the central rib. After repassing the line of the entire cut to trim the edges and to cut through some nerves still connected, it once more stations itself at the starting-point of the whole operation. With the claws of its legs, whose femurs are powerful levers, it next grasps the edge of the leaf, and walking now downward, now to the middle, it rolls up in less than two minutes one-half of the leaf into a sort of funnel, opening downward. After a short repast, which very prudently is taken from parts close to the main ribs, our little worker hastens to roll up the other side of the leaf around the funnel just formed, in which operation it uses its legs in a manner just the reverse of the former.

Now, after 30 minutes' work, the main preparations have been completed for depositing the eggs. The beetle crawls into the funnel's interior, cuts out three or four little pockets and introduces an egg into each. After this has been done, nothing remains but to close the precious chamber as firmly as possible. To accomplish this, it walks first to the upper end of the funnel and pierces the different layers of the leaf in such a way as to make them adhere to each other. Then it returns to the lower end of the leaf, and grasping its apex, forms a second funnel, with its opening directed upward and fitting exactly into the larger one (Plate I., fig. 1).

In doing all this our little architect, otherwise of so

timid a nature, exhibits such an interest and fervor that, as I myself more than once have observed, it does not desist from its ingenious work once begun, even though taken into the observer's hand.

Now in what does the real problem of the beetle consist, and what has it to do with the conservation of its species?

Unrolling the leaf and spreading it on a plain surface (Fig 2), we shall find that the exterior margin of the leaf and the S-curve cut by the beetle are in the same relation to each other as the two curves of higher mathematics, the involute and evolute, i. e., *v w*, *t u*, *r s*, *p q*, *l m* are almost perpendicular to the exterior margin *w u s q m*, and are equal to the corresponding curves *v y g*, *t y g*, *r y g*, *p y g*, *l y g*, respectively. In other words, our little mathematician cuts its S-curve so that the length of the cut made and the distance from the exterior margin always remain the same. This problem coincides with the task of higher mathematics, from a given involute to construct the corresponding evolute, and consequently involves a most complicate combination of differential calculus and geometry.

But to what kind of curve does the evolute of *Rh. betulæ* belong? As Prof. Heis first discovered, the evolute in this case is nothing else than an unfinished circle, which has its terminals in the joints *g* and *y*. According to the same authority, the more horizontal curve of the second half of the leaf is to be considered as a very appropiate flattening of the first curve, which has a more perpendicular position. For, since the broader exterior windings *A*, *B*, *C*,

PLATE No. I.

Fig. 1.—The Scientifically Constructed Nest of the Rhynchites Betulae. (After Wasmann.)

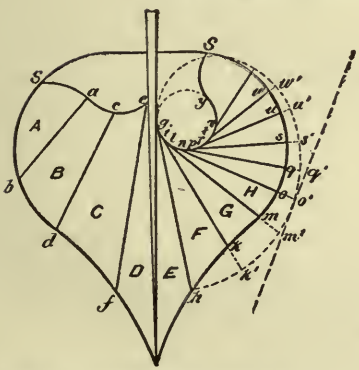


Fig. 2. (After Wasmann modified.)

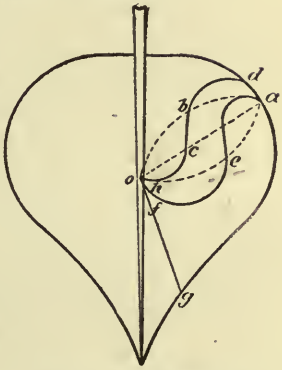


Fig. 3. (After Wasmann.)

The curve g w′ u′ s′ q′ o′ m′ k′ h′ represents the mathematical involute belonging to the evolute g i l n p r t v y.

correspond to the smaller interior *H*, *G*, *F*, without being shortened (i. e. *a b* and *c d* are equal to *l m* and *i k* respectively), the second S-curve must necessarily lie in a more horizontal position.

This is one part of our little builder's problem. The other consists in the suitableness of the chosen curve to the formation of a funnel. Supposing that the beetle wished to construct from the birch leaf the largest and strongest funnel possible, and that, too, in the shortest time and with the expenditure of the least amount of its limited strength, it could really not choose a more suitable curve.

The funnel may be considered as a surface conically evolvable which, when spread out upon a plane, coincides with it in all its points. Now such a surface can be rolled up in two ways, so that the lines of convolution meet either in one point or in a row of points, lying in a straight or curved line (Fig. 3). To have them meet in one point is, in our case, altogether out of question. For apart from the fact that the central rib would most probably tear in the course of the operation, it would exceed the strength of our little beetle to handle the whole surface *o a* at once. Therefore, the second manner of convolution had to be chosen. Yet here again it would not do to have the upper margin in a straight line, for in rolling up the leaf, the upper and lower openings would have to become either equal in their respective diameters, and we would have no funnel, but only a useless cylinder; or they would be unequal, the larger opening being either above or below. If above, the funnel, because reversed, evidently would not serve its purpose;

if below, the length of the side *o a* would either not correspond to that of the outer edge *a g* or at least the oblique position of the funnel would make it impossible to wind the other half of the leaf around it. The margin, therefore, must be a curved line. But this curved line again would be either convex or concave; or partly convex, partly concave. Of these possible cases, the first two would be impractical; for the merely convex margin has all the disadvantages of a straight one, and, besides, would make the poor beetle do superfluous work in rolling up a part of the leaf (*o b a c*) that is of no use in the formation of the funnel. A funnel with a merely concave margin would have too many windings closely packed at the top, and thus overtax the strength of the builder; and the funnel, which is subsequently to serve also as food for the larvæ, would perhaps have dwindled down too much in size.

There remains only the concavo-convex line of section, in which again either the convex or the concave part might be longer. And here, as Wasmann justly remarks, "the technical ingenuity of our architect shows itself in its brightest light." For what would be the result if the convex part were longer? We need only cut such a funnel from paper and see. First of all, it is not pointed enough. Besides, the part *h b* is not in the spiral of the point, as it should be, but along the vertical axis, and thereby the curve *o c b d* will no longer have the required length. And the part *c a b d* would most unsuitably protrude above the funnel's apex. At any rate, the funnel would be

lacking in firmness and could not be closed so tightly as it should be.

But if, as is actually the fact, our architect chooses to make the concave part of the margin longer in the above mentioned proportion to the leaf's outer margin, then all requirements are most admirably met, and not a trace of the disadvantages of the former methods can be discovered. Without wishing to maintain that no other curve might possibly bring about the same result, there is certainly none so simple and yet so wonderfully appropiate.

To understand this still more clearly, we may finally direct our attention for a moment to the purpose which the funnel has. What is the real destiny of this artistic house? To insure the preservation of the species of *Rhynchites betulæ*, it is absolutely necessary that in its larval stage the young progeny should be guarded against all harmful influences resulting from atmospheric changes. Now it has been experimentally proved that every larva, in spite of abundant food, simply dries up when taken out of the tightly rolled and well-sealed funnel. Moreover, on account of the constitution of its stomach, the larva can feed only on dry leaves, supplied by its habitation. That the birch leaf might be dry in due time, the mother beetle wisely provided by making the incision in the leaf's central rib. Finally, because the number of its progeny is so exceedingly small, it had to guard them well against all insectivorous animals. But who can suggest a hiding-place better adapted to its purposes than a dry, meaningless leaf, rolled up and closed with so great care?

A great many other examples of a less impressive but similar nature could be enumerated, all evincing the self same conclusion that the instinctive actions of animals are of themselves highly appropiate to their purpose and reveal a true final tendency.

Or, for what other reason but to seek protection from danger do worms contract the segments of their body, hedgehogs roll themselves into balls bristling with spikes, snails retire into their shells, turtles withdraw their heads and legs and hide themselves in the sand, young snakes jump into the mouth of their parent, chickens seek protection under the wings of the hen?

Nor can any other explanation than "purpose" be given for those actions by which animals preserve their species. Or, why do they always deposit their eggs in places which offer the most suitable food for their offspring? Why do mosquitoes drop their eggs into water, the only place where the young can develop, cabbage-butterflies deposit them on the under side of the cabbage leaf, Sitaris in the nest-entrance of Antophoras? Why does the fly Gastrus equi paste them on the breast of a horse, where they are licked up by the horse's tongue and forwarded into its stomach, the only place where the maggots find their specific and necessary nourishment? Why do several species of solitary wasps fasten their eggs on the bodies of living but paralyzed spiders, caterpillars and grasshoppers?

Why does the great water-scavenger, Hydrophilus piceus build a little boat for its eggs, and Lomechusa, Xenodusa, Atemeles . . . bring them into the nests of ants; why in short does every species find

those places and conditions, which are best adapted to secure the welfare of its offspring? There can be no question of chance where such a universal experience confronts us with such wonderful facts, and it is consequently evident that a "purpose" in finding suitable nourishment, in protecting the individual and propagating the species is an essential constituent of all instinctive actions of animals.

Chapter III.

Instinct and Consciousness of Finality.

INSTINCTIVE actions are essentially of a purposeful and seemingly intelligent character being directed, as we have shown, toward the welfare of individual and species. We must now examine what relation instinctive actions have to the agent's cognition and appetency? For the answer to this question will determine the specific character of instinctive actions in contradistinction to all other kinds of actions performed by man or animal. Hence we ask whether we are justified to infer that the final tendency which is evidently manifested in the case of the instincts is as such or in itself an object of cognition and volition on the part of the agent. Some believe that it is impossible to answer this question in a satisfactory manner. Ladd says of instinctive actions that "they *seem* like the deeds of intelligent will striving to realize ideas held up by imagination and thought." But, "how far an actual examination of the data of consciousness justifies the seeming, is a question which can probably never be answered satisfactorily." [1])

[1]) George Trumbul Ladd, Psychology, descriptive and explanatory, 4. ed., New York, 1903, p. 598.

We believe that this is not so. It is certainly impossible to determine in detail *how* the single instinctive actions are performed and how they originated. But the simple fact whether or not they proceed from an intellectual or a merely sensuous principle or from no principle of cognition at all can, we believe, be easily ascertained. Let us see.

Our first proposition is that, as in the instincts of man so also in the instincts of animals, the connection of the action and its final purpose is entirely unconscious; or as James says: "Instinct is usually defined as the faculty of acting in such a way as to produce certain ends, without foresight of the ends, and without previous education in the performance." [2])

We are led to this conclusion first of all by the *perfect analogy* that exists between the instinctive actions of animals and of man himself. For there are many actions of man of an instinctive nature and perfectly similar to the corresponding acts of animals. Consequently, if the instinctive actions of man are unconscious, the same must be asserted of the instinctive actions of animals. The hungry babe endeavors to suck, or gives expression to its feelings by crying, until its mother has appeased its craving. It is evident that these actions are appropriate to the purpose; nor is it less evident that they are the result of instinct and not of reason. But how? Is the babe *conscious* of the final tendency of its actions? Does it cry because it *knows* that crying is a means to induce its mother,

[2]) W. James, The Principles of Psychology, vol. II. 1904, p. 383. James' definition is incomplete, as we shall point out below.

to satisfy its hunger? Evidently not. For our own experience proves that as children we were not conscious of the suitability of such acts. Moreover, the supposition of consciousness on the part of the child involves a contradiction. Its knowledge of the appropriateness of the action would have to be derived from nature or from experience or from personal reflection. The first assumption is inadmissible; for there are no innate ideas. Nor can there be a question of experience; for the new-born babe cries previously to all experience of the result of its wailing. Nor can we fall back upon reflection; for the child is incapable of using its mental faculties. Therefore, the cry of hunger is entirely unconscious. The same must be said of all our instinctive actions even of those which are performed after we have attained the use of reason. Our consciousness offers unmistakable testimony that we do not reflect in extending our hands or closing our eyes on the sudden and unexpected approach of a dangerous object. This fact leads to the inference that animals, likewise, have not the remotest idea of the appropriateness of their instinctive activity.

But here we are confronted by some who reject this conclusion from analogy and entirely disregard the fact, that it is the only way of gaining insight into the functions of the animal soul.

It is under the influence of this opinion that Professor Ziegler writes in his treatise on the nature of instinct: "We must leave aside the notion of consciousness, if we wish to acquire a useful concept of instinct." For, "who can tell whether a dog, a lizard, a fish, a beetle, a snail, a worm act consciously or un-

consciously? In the natural sciences it is a very doubtful proceeding to admit into a definition any mark which cannot be judged upon empirically."

On the contrary, we must insist on a principle well explained by Romanes in his "Animal Intelligence." "Taking it for granted," he says, "that the external indications of mental processes which we observe in animals are trustworthy, so that we are justified in inferring particular mental states from particular bodily actions, it follows that in consistency we must everywhere apply the same criteria. . . . It is, of course, perfectly true that the less the resemblance, the less is the value of any analogy built upon the resemblance, and therefore that the inference of an ant or a bee feeling sympathy or rage is not so valid as is the similar inference in the case of a dog or a monkey. Still it is an inference, and, so far as it goes, a valid one—being, in fact, the only inference available. That is to say, if we observe an ant or a bee apparently exhibiting sympathy or rage, we must either conclude that some psychological state resembling that of sympathy or rage is present, or else refuse to think about the subject at all; from the observable facts there is no other inference open." Romanes adds that the analogy from human to brute psychology becomes weaker and weaker as we recede through the animal kingdom downwards from man; but he insists that "it is the only analogy available" and "that when we get down as low as the insects I think the most we can confidently assert is that the known facts of human psychology furnish the best available pattern of the probable facts of insect psychology." [1])

[1]) p. 8.

Romanes is correct in insisting upon this analogy. For from like effects we may and must conclude to like causes, and consequently it is sound logic to maintain that, if two actions have the same manifestation in man and animal, they must be similar in their nature. He who denies this principle can make no statement on animal instinct, since by internal experience he is acquainted only with his own instinctive actions, whilst he has no knowledge whatever of their nature in other men, much less in animals.

But we may go still further than Romanes. We need not compare the instinctive actions of man and animal in every respect, but may restrict our present consideration for instance to the manifestation of consciousness of finality. Now human psychology furnishes us with a number of data taken from circumstances which clearly demonstrate that the actions in question cannot possibly involve any cognition of final tendency as such. Hence, if we can show the presence of the same identical data in the instinctive actions of animals, we have a perfect analogy and hence a reliable conclusion.

Our first argument in support of this statement is taken from the very performance of instinctive actions on the parts of animals.

Let us return to the illustration taken from the larva of Sitaris humeralis. Whence does it know that in its first larval stage it can live only on the egg of a bee? Whence is it aware that it may indeed start out on its trip on the back of the male, but must in the course of it pass over to the female bee and finally glide down upon the egg? Whence does it know that

in its second stage honey and only honey is to be taken as nourishment, though precisely this same honey would have caused its death in the first stage? Does it know it perhaps from experience? But only once in its life does our larva undertake this journey through the air, only once does it feed on the bee's egg, only once on the honey of the cell. Moreover any attempt at experiments would have resulted in death. Therefore, Sitaris does not know from its own experience, how and where it has to provide for its development. Nor is it less ridiculous to assume that a very good memory aided our larva in finding its proper food. That would indeed be a unique memory which remembers facts that have never been experienced. But somebody else, perhaps a careful mother, might have given her darling definite instructions as to the future before it departed from home. Indeed, an idyllic idea! It is too bad that professor Sitaris had to die before even one of her disciples could leave the egg. Therefore, we must either suspect with the elder Agassiz that instinct is a faculty of a much higher kind that the intellect of man, or take refuge in the ridiculous caricatures of Brehm's intelligent dolls, which previous to any experience excogitate by aprioristic reasoning the actions most appropiate for their future life. But as these suppositions are evidently absurd, we must necessarily assume that Sitaris performs these instinctive actions without any knowledge or consciousness of their purpose; for a purpose which cannot be apprehended is not apprehended *de facto*. The same conclusion is forced upon us by the action of the Rhynchites betulæ in cutting a curve into the leaf of a

birch-tree, whose construction, if performed by man, implies the application of geometry and calculus. The same explanation is demanded by the action of the male-larva of the stag-beetle (Lucanus elaphas), which spins a cocoon for its future antlers twice as large as does the female larva; the same of the so-called silk-worms which when constructing their double-walled cocoon for the winter season leave a true but well closed door for escape in early spring. (Plate II. Fig. 1.)

Nor can any other reasonable interpretation be given of the actions of birds which after their very first mating begin to gather blades of grass and like material for their future nest, deposit their eggs in it and hatch out their offspring. Nor does the apparent sagacity of domestic animals in distinguishing so well and at once between hundreds of poisonous and nutritious herbs warrant any other conclusion. In fine, all instinctive actions of animals at least at their first occurrence and previous to experience cannot be explained otherwise than by the conclusion that under the mere impulse of instinct animals are entirely unconscious of the final tendency, so brilliantly manifested in their highly appropriate activity.

A second proof that animals cannot know the purpose of their instinctive actions has often been derived from their peculiar and constant regularity. "A still more important reason," says Wundt, "which opposes the derivation of merely instinctive actions from conscious reasoning, may be found in the fact that they are repeated by all individuals of the same species with great regularity, though there is no possibility

PLATE II.

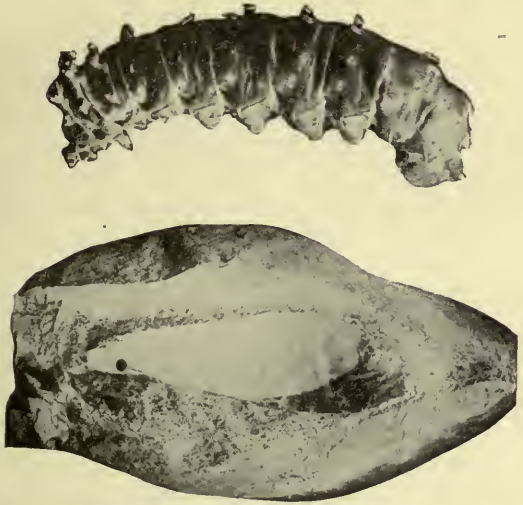


Fig. 1. The silk-worm Attacus Cecropia and its cocoon. (Original.)

Fig 2. A Solitary Wasp "using stone to pound down earth over nest." (Peckham.)

of proving that between the single individuals there exists any connection which might explain the perfect agreement in their behavior." And the zoologist Schneider adds in still clearer terms, "that in the habits of insects a regularity and predetermination should be observed which cannot be detected in the conscious actions of man. In opposition to merely instinctive habits precisely those associations which are formed by ratiocination are characterized by a constant variation, whilst the instincts of the individuals of the same species remain constant." [1])

Here is an illustration of this well known fact, mentioned by Peckham. The solitary wasp Sphex-ichneumonea leaves her grass-hopper (which is to serve as food for the young) just at the entrance to the excavation (of her nest) and first enters to see that all is right within. In experimenting with a French Sphex, which has the same habit, Fabre (the famous French naturalist mentioned above) moved the creature a little way off; the wasp came out, brought it to the opening as before, and went in a second time. This was repeated again and again until the patience of the naturalist was exhausted, and the persistent wasp took her booty in after her appropiate fashion. She must place the grass-hopper just so close to the doorway, she must then descend and examine the nest and after that must come out and drag it down. Nothing less than the performance of these acts in a certain order satisfies her impulse.

[1]) Cf. T. Pesch, S. J., Die grossen Weltraetsel, 1883, vol. I., p. 426.

There must be no disturbance of the regular method or she refuses to proceed. [1])

This argument is rendered still more efficacious, if we consider how often this very regularity of the action destroys its appropriate character, although in common circumstances every instinctive action is adapted to its purpose. It may happen that these circumstances are disturbed by man or some other cause. Now if the animal were conscious of its instinctive actions, it evidently would either desist from acting or adapt its action to the changed conditions. But as many facts have proved, animals prefer to exhibit the most stupid performances rather than change their usual course of procedure. A goose deprived of its embryo goslings continues with great zest to hatch on the dunghill, and hens will do the same on pseudo-eggs and iron chains. Birds, that have seen their offspring killed before their eyes, continue to gather food for their fledglings. Altum vouches for the fact, that some northern birds when deprived of their eggs go so far in phenomenal stupidity as to collect food and disgorge it in the nest when the time has arrived for the appearance of their brood, as if it were actually present; or they offer food to the eggs which have become addled by excessive hatching. [2]) Chickens have the instinct of scratching which ordinarily serves to expose their food or prepare their nest. But they also scratch on a stone floor or on the top of a heap of grain, and do not pick up a single morsel without dashing a dozen or more against the opposite wall. Insects which in case of

[1]) 1. c., p. 212.

[2]) Dr. B. Altum, Der Vogel und sein Leben, 6. ed., p. 200.

danger simulate death and drop on the ground do exactly the same if instead of firm ground there is a pool of water below them. Even ants, in spite of their highly developed faculty of adaptation, do not act less stupidly. Generally speaking they adopt in observation nests the same line of instinctive actions which were useful to them in their natural state, although in the changed conditions those actions are often useless and even harmful.

Instances such as these could be multiplied indefinitely. At present let us add but two striking illustrations which Peckham enumerates as "errors of instinct." Cerceris ornata is the name of a solitary wasp, which is known to kill certain bees of the genus Halyctus by means of its sting, to carry them into its nest of sand and place an egg upon the ventral side of the bee. One day "while Cerceris was away hunting, some dry sand was thrown into the nest, and the entrance was then stopped with damp sand. She returned laden with prey, and seeing herself forced to resume the profession of a miner, abandoned her victim, cleared the entrance, penetrated within, came out again and flew off in search of new prey. After two successive trips she penetrated a third time into her dwelling and began to reject the dry sand which had been thrown in. In the midst of this sand was a bee (which she had dropped before). Presently the wasp flew away. The hours passed on and she returned without a bee, entered and threw out the other one which she now considered an encumbering object. Thus of two victims which were procured with great trouble, one was abandoned on the thresh-hold, and the other was dropped halfway

in—neither served as food for larvae. What of that? Cerceris had given the sting—that was enough. At another time a nest, one of the cells of which was not entirely provisioned, was destroyed at evening. On the next morning Cerceris brought a newly stung bee and placed it in the hole. On the following day she came again charged with prey and dropped her bee which rolled to the bottom of the excavation. She had not brought the full number for provisioning the nest. Instinct commanded her to bring them, and she obeyed but not knowing where to put them, let them fall.''[1])

From such instances we must conclude that instinctive actions as such are never connected with consciousness of final tendency. For these cases of inappropriateness do not occur only now and then, but may be occasioned in any kind of instinctive actions. They cannot be the result of a misleading reflection or of an erroneous judgment influenced by will power, or by the appearance of truth; for of this there can be no question in actions so stupid, useless, and often injurious.

[1]) l. c., p. 219-220.

Chapter IV.

Instinct and Sensuous Cognition.

IN the preceding chapter we have proved that, in spite of their eminent appropriateness, the instinctive actions of animals do not betray the slightest trace of consciousness of finality. But we are not allowed to infer that all unconscious actions which manifest a final purpose have to be classified as instinctive. If this conclusion were legitimate, many vegetative processes and vital actions which are merely automatic would have to be referred to the domain of instinct. In fact, some scientists admit a so-called organic instinct. But at the very first glance it is evident that the term is not used in its proper meaning. Or is the action of plants instinctive, when they take in sap by their roots or carbon-dioxide by their leaves? This would be as incorrect as to maintain that the beat of the heart and the respiration of the lungs are guided by instinct. For, neither vegetative processes nor reflexive activities can be termed instinctive actions, but only such as are connected with *sensuous cognition and appetency*. Now, first of all, there can be no doubt of the fact that instinctive actions are at least in some way determined by sensitive cognition. For as experience shows, animals distinguish very well in their instinctive actions between the different objects that surround them and administer to their wants. Birds never take the insects which supply their food for the material out of which

they build their nests. Who ever saw a swallow constructing its nest of flies or mosquitoes and feeding its young with mud? What else, than some kind of sensuous cognition guides the hawk when it swoops down from on high and grasps its prey with unfailing certainty? What else always impels the hen to gather its chicks under its protecting wing on the first approach of such a dangerous visitor? Indeed, Descartes, misled by the regularity of instinctive actions, spoke of animals as of automatic beings and thought that he could explain animal activity by his "spiritus vitales," certain liquids of a merely mechanical nature. But in doing so he disregarded the fact that animals have real organs that produce effects similar to those which are brought forth by the sensitive cognition of man and he forgot how variable within the limits of a certain regularity instinctive actions may be. Therefore, the fact that some kind of sensitive cognition determines the animal, when acting instinctively, is beyond all doubt.

Nevertheless, there are some modern scientists of no small reputation who follow the example of Descartes and maintain that instinctive actions are in no wise influenced by sensitive cognition, but are of a merely mechanical nature. One of these scientists is Prof. Jacques Loeb [1]) of the University of California, well known on account of his experiments regarding artificial parthenogenesis. [2]) Loeb boldly asserts:

[1]) Studies in General Physiology, Chicago, 1905, vol. I. pp. 1—114.

[2]) We may note here that these experiments have nothing to do with the great question of primo-genesis. For, all experiments of Loeb suppose life, and there is none among them

"What has been taken for the effect of 'will' or 'instinct' is in reality the effect of light, of gravity, of friction, of chemical forces, etc." And so he speaks of *heliotropism*, when the direction of the rays of light determines the direction of the movements of an animal or its orientation; of *geotropism*, when gravity, or of *stereotropism*, when contact with solid bodies determines the orientation, and so forth.

Heliotropism, geotropism, and stereotropism may be positive or negative. They are positive, if the animal's motion is towards the light, the earth, or a solid; negative, if in the opposite direction. In further description of his purely mechanical theory, Prof. Loeb uses the following altogether "unequivocal" phrases: "By the help of light the botanist controls the orientation of a plant at will. Why should he maintain that the 'will' or 'instinct' of a plant [!] cooperates with the rays of light when the orientation is determined solely and unequivocally by the latter? The movements of an animal toward the light are, however, ... identical point for point with the movement of a plant toward the light. Wherever the orientation of plants has been satisfactorily controlled experimentally, light has indeed been considered the sole determining factor; but in the case of animals, in which in similar experiments light is without doubt also the sole determining factor, 'instinct' and 'free will' [sic!] have still been considered to play a role."

that could be interpreted as having any connection whatever with spontaneous generation. Cf. our paper on "Modern Science and the Origin of Life" in the New York Messenger, April, 1906.

Loeb grants that life-phenomena are "not dependent *solely* upon the external causes acting upon the organism at a given moment, but upon these and upon the conditions present within the organism taken together; and the latter conditions are in themselves variable."

But this does not affect in any way the mechanical character of his theory. The manifestation of heliotropism changes, but it remains pure and unequivocal heliotropism. Thus "a large number of animals become positively heliotropic, when they are left in the dark for a long time. If they are brought into light of sufficient intensity, they become negatively heliotropic after a time and this the more quickly the more intense the light." "We do not therefore always meet with simple conditions in analyzing the causes which determine the voluntary movements of an animal; but however complicated they may be, the voluntary movements of animals are nevertheless, as our experience indicates, always unequivocally determined only by such circumstances as determine also the movements of bodies of inanimate nature."

On what facts does Loeb base his theory? Let us give at least one characteristic example.

The caterpillars of *Porthesia chrysorrhoea* pass the winter in their nests in fruit trees and bushes, which they leave as soon as it becomes warm. Then they creep up to the tips of branches to the small buds which serve as their food. Now, as Loeb expressly states, it is merely positive heliotropism and negative geotropism which compels the caterpillars to creep upward, where they are held fast on the small buds by contact-irritability. For you can make the cater-

pillars starve by the aid of light in close proximity of food. "The animals move to the window-side or to the top of a test-tube in which they are kept. If, then, a branch, covered with buds, is pushed into the test-tube on the room side, the animals nevertheless remain where light and gravity have compelled them to go and are holding them. If, however, they once are on the buds, the latter act as a stimulus which may be even stronger than light. It is in such a case impossible to draw the animals away from the food by means of light." Besides these animals retain their positive heliotropism only as long as they have not yet eaten anything. "As soon as they have eaten and are about to moult, their irritability decreases and at the time of moulting it is almost impossible to show any effect of light or gravity upon them."

We believe that Prof. Loeb's explanation contains his refutation. For, if his theory were correct, all caterpillars would be doomed in consequence of positive heliotropism. Caterpillars usually commence eating the buds of the highest twigs, and having devoured all in their reach above them, they rest for some time, until all is more or less digested. Now in order to get new food, they must necessarily creep down to another twig or tree. But this is impossible. For, their "stomachs" being empty, the caterpillars are positively heliotropic, and consequently they will all die on the spot. This, however, is directly opposed to the facts. There are no caterpillars in nature that die in consequence of heliotropism or geotropism. As long as they are hungry, they creep from one branch to another and in all possible directions, until

they find the desired food. That they did not do so in case of Loeb's test-tubes is merely due to the fact that they were not aware of the food, since this was at an altogether unusual and dark place. Hunger, and nothing else than hunger, is the cause which impels the animal to follow the guidance of its senses in order to appease that craving. This is the sole reason why, as soon as the caterpillars have eaten, and at the time of moulting, "it is almost impossible to show any effect of light or gravity upon them." It is not heliotropism, but hungertropism, or, to speak still more scientifically limotropism, that accounts for the caterpillars creeping upward.

Prof. Loeb takes the liberty of sneering at the use of words like "instinct" to designate causes of movement, and says that such causes stand upon the same plane "as the supernatural powers of theologians, which are also said to determine motions, but upon which an engineer could not well rely." He moreover declares the method of Scholastic thinking a "handicap" which, by phrases like "instinct" serves to ignore or conceal the true problem involved.

Prof. Loeb forgets that there are two kinds of problems to be solved: the one referring to the more remote and ultimate causes of phenomena; the other pertaining to their proximate causes and relations. Both are objects worthy of the intellect of man, and neither is opposed to the other. But while the second is of interest to the specialist only, and has no bearing on the great questions of human life, the other is of interest to every man who is anxious to study the foundations upon which his relations to his fellow-

creatures are based and on which his final destinies depend. Indeed, if Prof. Loeb would take the trouble to study the definition which St. Thomas gives of the *vis aestimativa* in animals, he would find more wisdom in that one definition than his previous unacquaintance with that author had ever permitted him to suspect. This unacquaintance with the Scholastic method of thinking is the very handicap which makes him "conceal the problem" beneath the veil of a few Greek phrases.

Loeb as well as Bethe, Uexkuell and others mention a great many facts [1]) of a nature similar to the one explained. But it is unnecessary to enter upon them. For far from demonstrating that the movements of animals are merely due to mechanical causes, they show rather the evident fact that *some kind* of sensitive cognition guides the animal in the performance of its instinctive activity.

But we may ask, does sensitive cognition suffice to explain the phenomena of instinct? The *exterior* senses as such certainly do not. For the mere preception of something green will not induce the cow to eat; for in that case the cow would eat any kind of green matter, poisonous herbs or only colored paper. But this does not agree with facts. On the contrary, just as hens when threatened by a bird of prey are at once aware of their danger, but never call their young when

[1]) Cf. E. Wasmann, S. J., Instinkt und Intelligenz im Tierreich, *Third edition*, (Herder 1905), p. 136-168.

This edition of Wasmann's work is practically a new book.

Morever, Wasmann, Die psychischen Faehigkeiten der Ameisen; Zoologica, Heft 26 (1899).

the bird soaring over them is not inimical, thus also do cows on entering a meadow for the first time distinguish most exactly between nutritious and poisonous herbs. Experiments begun by Linné have brought out the fact, that of all herbs within their reach cows select about 276, whilst about 218 are passed by; and precisely those 276 correspond to the cow's organism, whilst as experience proved many of the other 218 are of a poisonous character. If, therefore, the exterior senses alone are not sufficient to explain the facts, will the *interior* sense give us a satisfactory answer to the question, how animals are enabled with such unfailing certainty to distinguish between the beneficial and harmful? Will an interior sense (sensus communis) suffice to explain that wonderful sagacity of animals, by which they choose their proper nourishment, by which they adopt the most appropriate means of defence and propagation? *If* the animal's interior sense is exactly the same as that of man, then, indeed, we must confess that the phenomena put before us are altogether inexplicable; for the interior sense of man as such, without the guidance of reason, is not sufficient even to preserve us from the greatest dangers. The child in the forest smiles, when it takes the poisonous berry; and its tender life is preserved only by the care of a loving mother, who is endowed with reason, until its own dormant intellect is active and begins to be its guide. Must we then fall back on an intellect to explain facts otherwise inexplicable in the instinctive actions of animals! Must we defend Brehm's ridiculous dolls? If so, we must go farther than Brehm went, and ascribe to animals an intelli-

gence far superior to our own; we must bow down before the animal, which manifests from the very first day of its existence a degree of wisdom that men acquire only after years of experience and laborious study. Let us not forget the example of the Rhynchites betulæ, but remember how this tiny beetle "without any study solves mathematical and technical problems, which the mind of man has brooded over for centuries; how at the very first trial it performs its work with the greatest perfection, though no parents, no brothers or sisters were its teachers, though no experience extending over years developed the use of its faculties; how with marvellous anticipation it provides for future circumstances, of which it could have no notion whatsoever either by its own experience or by human ratiocination; how in fine under ordinary circumstances it communicates to its work such manifold perfection and such appropriateness for the desired purpose that the thousands of specimens of man's art and industry seem to be the unfinished work of an apprentice." [1]) Undoubtedly an intelligence is manifest in the instinctive actions of animals which evidently surpasses that of man. And yet the elder Agassiz and his followers err in attributing this intelligence to the animal itself and in maintaining that in the question of spiritual faculties man should not arrogate to himself a privileged position in the animal creation. This supposition not only destroys the dignity of man and elevates the animal to a sort of God-like being, but brings us into collision with indisputable facts. In-

[1]) E. Wasmann, S. J., Der Trichterwickler, 1884, p. 56.

deed, as we have proved, there is no greater error imaginable, than to attribute to animals, when acting instinctively, an intellect similar to that of man. If then the animal acting under the laws of instinct cannot boast even of a human intelligence, then all intelligence of a higher kind is *a fortiori* excluded. No, the superhuman intelligence, radiating, as it were, from all instinctive activity, does not abide in the animal itself. On the contrary, we are impelled with logical necessity by most evident facts to acknowledge a being which many nowadays are so surprisingly loath to admit, namely, a divine Intelligence, distinct from the animal and from the whole creation, a personal God, infinitely wise and powerful. But since it is repugnant that this God personally governs the animal's instinctive activity by endless miracles, we have to assume that the Infinite has inscribed in the animal as in every living being an immanent law according to which the animal by its own activity performs its instinctive actions. And wherein does this law consist? As we have seen the facts do not allow us to assign to the animal when acting instinctively a higher faculty than sensitive cognition and appetency. Consequently, we have to infer that the law imprinted in the animal-soul consists in this very sensitive cognition and appetency, qualified in such a way that, as St. Thomas says, "what is the specific object of pleasure to the animal" is at the same time "the best and most appropriate object of its well being."

What, therefore, is our definition of instinct? Ladd says: "The simple fact is that we find men and the lower animals generally, using the structure with

which they are gifted by nature, in ways significant of feelings of craving, of anticipations of ends, and of adaptation of means which considered in themselves imply far higher degrees of conscious ideation than, so far as we can judge, really exists. To such complex conditions of consciousness with their motor accompaniments we give the term instincts." [1]) In other words: Instinct consists in the sensuous cognition and appetency of the agent, which enables it to perform purposeful actions without becoming conscious of the purpose as such. The satisfaction of the animal's cravings guided by sense-experience normally coincides with its general welfare. How instinctive actions are actually performed by the agent, which nerves and which parts of the spinal cord and brain come into play, how external stimuli affect the end-organs of sense and set up a nerve-commotion that is propagated to the brain and finally acts upon the animal soul to elicit a purposeful action, all this is secondary and of no moment for our present dissertation. For our purpose it is sufficient to have brought out the principal characteristics of instinct and instinctive activities which are (1) final tendency without consciousness of final tendency; (2) sensuous cognition and appetency normally combining "the specific object of pleasure to the animal" "with the best and most appropriate object of its well-being."

[1]) l. c., p. 600.

Chapter V.

Instinct and Sense-Experience.

INSTINCTIVE actions are not absolutely uniform and infallible. On the contrary, they may be modified by experience. Ants kept in artificial nests generally fall with fury upon any strange object introduced into their midst. But this behavior may be modified. If a piece of ice is thrown among them, they first attack it violently. Soon, however, they experience the fatal cold and retreat, taking sooner or later a "lesson" for the future. The question is whether this element of experience changes the nature of an instinctive action and elevates it to the rank of such as proceed from intelligence.

As we have indicated, it is the general opinion of modern naturalists, that only those actions of animals are instinctive which immediately arise from hereditary disposition, whilst all those which pre-suppose individual experience are due to intelligence.

Mr. George W. Peckham of Milwaukee, who has written some interesting papers on spiders and a splendid monograph on the instincts and habits of wasps, explains this general opinion as follows: "*Under the term instinct* we place all complex acts that are performed previous to experience and in a similar manner by all members of the same sex and race, leaving out as *non-essential*, at this time, the question of whether

they are or are not accompanied by consciousness. *Under intelligence* we place those *conscious* actions which are more or less *modifiable by experience.*" [1])

Therefore, whenever an animal makes use of a former experience or adapts its manner of acting to the changed conditions of its surroundings, its actions are manifestations of inteliect; and *vice versa*, whenever the animal is determined by inherited impulses its actions are merely instinctive. In other words, if we have to decide in a given case whether an animal acts instinctively or intellectually, we must answer the question: "Did any previous or actual experience modify the action or not?" If the answer is affirmative, that is to say, if the animal was influenced by experience to adopt an appropriate deviation from its general way of acting, the action is said to be the result of intelligence; if the answer is negative, the action must be ascribed to instinct.

What are we to think of this criterion?

Let us see: A criterion is a sign or characteristic mark which enables us to discriminate with certainty and under all circumstances between two or more objects or actions. Consequently, its first and most essential quality consists in this, that the mark or sign of distinction is *not common* to the objects or actions between which we have to discriminate. Hence, if it can be proved, that there are actions which in spite of modification by experience are undoubtedly of instinctive nature, the generally accepted criterion of distinction between instinctive and intellectual activity is

[1]) l. c., p. 231.

evidently false, because the characteristic sign of discrimination is common to both species of actions. Is this the case?

Speaking of the so-called Pelopaei (Mud-Daubers), Mr. Peckham says, that "originally they built under overhanging rocks and in hollow trees." And now, "when near human habitations these wasps make use of the more convenient positions which they offer." "The spot chosen for the nest may be in a barn up among the rafters, in an outhouse, under the roof of a porch, or, indeed, in any sheltered place where it will be protected." [1]) According to Mr. Peckham's criterion, the former mode of building in hollow trees is instinctive, whereas the latter mode of building in house-chimneys is an intelligent act. For the former does not depend on any experience whatsoever, whilst the latter is a modification of the former, due to actual experience. And in reality Mr. Peckham enumerates this example among the instances which he advances for the intelligence of wasps.

But does the experience which influenced the former mode of action change its instinctive nature?

Every wasp is endowed with instinct. Hence it possesses the inherited faculty of forming associations of sense perceptions and feelings necessary for the preservation of its species. But the single associations as such are *not* inherited. For, if this were the case, we would have to assume special innate forms of cognition representing the exterior objects of every one of the thousands and thousands of instinctive actions of animals. But this assumption is as extravagant as it

[1]) l. c., p. 177.

is uncalled for. If, then, our wasp is wont to build its house of loam in a hollow tree, this act is not determined by an innate representation of this or that tree, but by an instinctive faculty which enables the wasp, unconsciously, to combine with its impulse to build a nest the representation of *any* hollow tree. Otherwise we would have to assume that an immense "picture-gallery" of all possible kinds of hollow trees pre-existed in the soul and ganglion centres of the wasp. For these wasps do not restrict their nest-building to trees of a special shape and form, but select any trees that seem fit for the purpose. It is evident that the wasp's action in selecting chimneys, where they are to be found, must be explained by the very same psychological laws which influence the selection of a hollow tree where no more convenient object is to be met with. For, *if the wasp has the instinctive faculty of combining the sensuous perception of any appropriate object with the corresponding sensitive impulse, why should this faculty not suffice for selecting any other appropriate place instead of a tree?* Indeed, the only difference between the two actions lies in this, that the perception of a chimney is more readily combined with the respective instinctive impulse than the perception of a hollow tree.

Consequently, the wasp's second action, which is modified by sensuous experience, belongs equally to the domain of instinct, and the above-mentioned criterion does not express the real difference between instinctive and intelligent activity. [1])

[1]) The following examples illustrate the same conclusion: Everybody admits that children *instinctively* shrink from a

We may affirm this conclusion with still greater confidence, as almost all the examples brought forward by Mr. Peckham are similar to the one we have chosen. . . . . Even when there is question of a whole series of sense perceptions which are associated with each other and modify the action of the animal, the criterion of the defenders of animal intelligence cannot be admitted, as instinct always implies the faculty of combining *any sensuous perception* unconsciously with its corresponding impulse. Hence it is an *arbitrary* assertion to maintain that this faculty does not suffice or that it loses its character, when there is question of many sensitive perceptions or of those which arise in the sensitive memory of the animal. As long as we remain within the realm of merely sensuous cognition, there is no reason for calling upon a higher faculty. But, there is one example in Mr. Peckham's book which seems to be of a different nature from the one explained above. Let us shortly consider the interesting case. Peckham's description is as follows:

red hot iron. But this manner of acting is due to experience. For, as we all know, children shrink from a glowing piece of iron only after having experienced the painful consequence of touching it on a former occasion. "A burnt child shuns the fire." Hence an action, though modified by experience, does not necessarily lose its instinctive character. Moreover, the above mentioned criterion eliminates from the realm of instinctive activity every action, from which the element of experience cannot be dissociated. As soon as a new-born pup begins to suck, it *experiences* the pleasant taste of its mother's milk, and its *experience* enters into and influences the continuation of the action. Consequently, an instinctive action would cease to be instinctive, as soon as it commences.

"Just here must be told the story of one little wasp whose individuality stands out in our mind more distinctly than that of any of the others. We remember her as the most fastidious and perfect little worker of the whole season, so nice was she in her adaptation of means to ends, so busy and contented in her labor of love, and so pretty in her pride over her completed work. In filling up her nest she put her head down into it and bit away the loose earth from the sides, letting it fall to the bottom of the burrow, and then, after a quantity had accumulated jammed it down with her head. Earth was then brought from the outside and pressed in, and then more was bitten from the sides. When, at last, the filling was level with the ground, she brought a quantity of fine grains of dirt to the spot and picking up a small pebble in her mandibles, used it as a hammer in pounding them down with rapid strokes, thus making this spot as hard and firm as the surrounding surfaces (Plate II, Fig. 2). Before we could recover from our astonishment at this performance she had dropped her stone and was bringing more earth. We then threw ourselves down on the ground that not a motion might be lost, and in a moment we saw her pick up the pebble and again pound the earth into place with it, hammering now here and now there until all was level. Once more the whole process was repeated, and then the little creature, all unconscious of the commotion that she had aroused in our minds, unconscious indeed of our very existence and intent only on doing her work and doing it well, gave one final,

comprehensive glance around and flew away." [1])

We do not believe that Mr. Peckham's interpretation of the facts is warranted by what he actually saw. The simple fact seems to be as follows: The pebble happened to be somewhat larger than the other material used in closing the nest. Anxious to fill up the burrow as perfectly as possible the wasp made a number of attempts to press the pebble into the ground. But all was in vain. The wasp did not succeed in forcing the pebble into the ground, so that all would be perfectly level. Hence after repeated trials she abandoned the pebble altogether. The fact that the wasp took up a pebble somewhat larger than usual is not wonderful at all, since it often makes use of a pebble of considerable size to deposit it into the lower part of the newly made nest. Hence we are not disposed to accept Peckham's claim that the wasp "improvised a tool and made intelligent use of it".

We distinguish therefore two kinds of instinctive actions, both proceeding from the self-same sensuous cognition and appetency. But while the first group springs *directly* from the inherited dispositions of the agent's sensitive faculties, the second group implies a modification of the actions through sense-experience. We do not insist upon mere names; and if any one prefers to introduce another phrase for designating instinctive action modified by sense-experience, he may do so. But no matter what term he may choose, the word "intelligence" (that is rational intelligence) is out of place, unless of course the word is taken in a

[1]) l. c., p. 22-23. There is a second fact recorded by Mr. Williston, which is of a similar nature.

merely analogous sense. For that word conveys the idea that all actions modified by sense-experience necessarily imply consciousness of finality, which is positively false. Prof. Wheeler says against Wasmann "that he has overshot the mark and attempted to include too much in his conception of instinct." "I should continue, therefore," he adds, "to emphasize the difference between activities which are compelled by inherited mechanism and those which imply choice on the part of the individual organism. For the latter the term "intelligence" has been so very generally used that it seems both hopeless and idle to restrict it, as Wasmann so emphatically desires, to the ratiocinative process in its clearest manifestations." [1]) We do not deny that true choice supposes intelligence. But we do deny that instinctive actions modified by sense-experience necessarily imply choice. What is "choice?" The Standard dictionary answers "that power of the will by which one freely prefers and selects as an end of action some one good out of those presented to the mind." This definition is clear and to the point. It evidently supposes that the one who chooses compares two or more objects with each other and having understood the relation of them to himself freely selects the one and rejects the rest. Here is an illustration well adapted for our purpose: On May 5th, 1905 we arranged an ant nest for Lasius interjectus consisting of two compartments connected by a small opening. Compartment No. 1 was dark, dry and without earth; compartment No. 2 was light and contained earth. About 100 ants with some 40 young larvae

[1]) l. c., p. 809.

were introduced into compartment No. 2. Within 15 minutes all had withdrawn into the dark compartment No. 1. On the following day the earth in compartment No. 2 was moistened. Soon the ants moved over from No. 1 into No. 2. But after some six hours the ants commenced with carrying over the moist earth from No. 2 into No. 1 which now was moist, dark and contained earth and thus was most comfortable. The action of the ants implies "choice" in as far as the one compartment is preferred to the other. But this is not "choice" in its proper meaning. The ants simply do and must do what they experience to be more agreeable to their senses. The concrete moist and dark compartment affects them more pleasantly than the other, and this concrete perception awakens the concrete desire to be in the more comfortable compartment, which again is followed by the appropriate locomotion of certain organs. But there is no indication of the ants becoming conscious of the abstract relation between the various conditions of the two compartments to each other and to their own welfare. Nor is there any trace of a free determination upon some alternative.

Choice implies logical thought and the power of abstraction. For without becoming conscious of the purpose of the action as such, without knowing and understanding why the one object is to be preferred to another, a true and free choice is impossible. It is clear, therefore, that instinctive actions modified by sense-experience do not necessarily imply choice. Otherwise we would have to admit that the wasp mentioned above compares hollow trees and

chimneys and, having studied and understood at least some advantages afforded by either, freely decides to depart from the traditions of its race and select chimneys for its future nest. We need not repeat that such an assumption is unwarranted. The "choice" of the wasp is no real "choice." In fact, it implies no more "choice" than many an action preceeding from inherited dispositions, such as distinguishing true food from poison and all indifferent material. The wasp "selects" a chimney, simply because it has the inherited faculty at a suitable time to react appropriately upon a concrete sensitive impression made upon it by a concrete suitable object without becoming conscious of the appropriateness of the action. It is anything but sensitive cognition and appetency, and there is no reason for attributing it to a higher faculty of abstraction and logical thought.

We agree, therefore, with Prof. Wheeler when he calls choice a characteristic mark of intelligence, but we differ from him when he asserts that modification by sense-experience necessarily implies choice. Besides we believe Prof. Wheeler does not lay sufficient stress on the fact above demonstrated that instinctive activities even in as far as they proceed from an inherited mechanism are directed by sensuous cognition and appetency and hence that they differ from merely reflex actions which include no sensuous consciousness whatever. For Wheeler simply speaks of "actions compelled by inherited mechanism," a definition which is certainly incomplete and characteristic of reflex actions.

We conclude, therefore, that Prof. Wheeler,

as well as most modern naturalists, defend a concept of instinct which does not apply to instinct at all, but to intelligence and to reflex actions. Let us now proceed to define more accurately the true distinction and criterion of discrimination between instinct and intelligence.

Chapter VI.

Instinct and Intelligence.

WHAT is the true criterion of distinction between instinct and intelligence?

A brief exposition of the nature of an intelligent act will furnish an answer to this question. We may define *intelligent*, in opposition to instinctive, activity as one that *is performed with perfect consciousness of its tendency, and is consequently guided by a purely spiritual faculty of cognition and appetite.*

The *first* part of this definition is self-evident, and sufficiently characterizes intelligent activity. Moreover, it is generally admitted. Thus Emery describes intelligence as the faculty of abstracting general ideas from the multiplex phantasms which have been acquired by experience, and of utilizing them in connection with sensuous images to perform actions which imply a conscious final tendency. And, strange as it may sound, all our opponents without exception, notwithstanding their own false criterion, endeavor to prove the intelligence of animals by ascribing to them a consciousness of final tendency. They do not commit the absurdity of denying the necessity of this tendency for such actions as the planning of houses, the framing of laws, the solution of mathematical problems and all purely intelligent activity, but readily admit that this very consciousness

of finality raises these actions to the level of intelligence. It would, therefore, be a quixotic fight against wind-mills to prove that the essence of an intelligent action demands the consciousness of its finality. No, the question at issue reaches much further. Wasmann lodges the complaint against Romanes, that he claims intelligence for all actions of animals that are based on sensuous experience, although he simultaneously acknowledges that intelligence consists in the power of drawing logical conclusions.

Wheeler, too, as we have seen, makes "intelligence" dependent on manifestations of "choice" and Peckham declares that intelligence is the power which "enables an insect to seek, accept, refuse, choose,—to decline to make use of this or to turn to account some other thing." [1]) But both Wheeler and Peckham maintain at the same time that modification in consequence of sense-experience renders instinctive actions intelligent. It is this deplorable contradiction which touches the vital point in the argumentation of even the most moderate defenders of animal intelligence.

They consider consciousness of purpose as inseparable from the utilization of experience; wherever there is sensuous experience there is consciousness of purpose, and *vice versa.* Their criterion states that every action is intelligent that is appropriately modified by any kind of experience; and still they insist on the consciousness of final tendency as the real essence of intelligent activity. Hence in their view the appropriate modification of an action by experience and conscious-

[1]) l. c., p. 231.

ness of its finality are so intimately connected that the one necessarily presupposes the other. But this is the fundamental tenet of materialism and destroys the true nature of an intelligent act. *Consciousness of purpose is impossible without spiritual cognition.* They are identical, and therefore our definition adds that an intelligent act is guided by a purely spiritual faculty of cognition and appetite. The whole question depends on the proof of this *last* inference.

Let us open the argument with an illustration. We select that of the babe in the cradle. Its reasoning faculty is still dormant. It is hungry and cries. Its mother puts a milk bottle into its hands. For a moment its desires are appeased. But soon the same scene has to be repeated, until finally the child finds the bottle of itself, when it feels the pangs of hunger. No one will dare to affirm that it has attained the use of reason, and yet no one can deny, that in consequence of repeated experience in some way or other the feeling of hunger and the milk-bottle are connected in the child's perception. Otherwise it is impossible to explain why the child constantly grasps the bottle when it is hungry. But who will maintain that the babe acts with *consciousness of the finality of its action?*

Here is another example. When Rhynchites betulæ feels the natural impulse to lay eggs, it invariably prepares a funnel-shaped depository and lays its eggs in the folds of this artistic bed. It evidently perceives in some way a connection between the funnel and its impulse to lay eggs. Otherwise this beetle would neither prepare the funnel nor al-

ways place its egg precisely in the requisite folds, but would at least, once in a while, deposit them elsewhere, on a more convenient spot. But, does this perception warrant the conclusion that R. betulæ acts with consciousness of finality? Undoubtedly not. For an action that is guided by "purpose" and performed with "consciousness" demands *far more* than a *mere combination of the phantasms of things which are related to each other as means and end.* This *very relation of end and means must be clearly recognized as such.* Or, as St. Thomas puts it: "The perfect knowledge of an end demands not only the perception of the object which constitutes that end, but its recognition as an end and its relation to the means used to attain it." But this evidently implies the formal cognition of finality, the clear perception of the *abstract relation between means and end.* When a man wants to enjoy his breakfast with *consciousness of finality*, it is not sufficient to combine in his imagination the concrete things before him and his concrete impulse to eat them, a combination which naturally produces an agreeable feeling and calls forth an appropiate exercise of the limbs towards the breakfast table, but he must understand the abstract relation between the savory beef-steak as the means and the satisfaction of his hunger as the end, and guided by this cognition he must eat his breakfast.

Therefore, every action that is guided by "purpose" and directed by "consciousness of purpose" presupposes as least requisite the *cognition of means and end as such, of relations as such, and consequently implies universal ideas.* Thus far few of our opponents will find

any difficulty in admitting our argument. But our ways separate, when we put the question: *Is a sensitive power of cognition able to form general notions or not?*

To answer this question we must first of all inquire into the nature of a universal idea and investigate its main difference from a so-called common phantasm. When Clarke [1]) calls the distinction between the abstract idea and the common phantasm of the imagination "the very touchstone of a philosophical system", he enunciates a truth that is of paramount importance in our present investigation. Everywhere in the writings of those who defend animal intelligence, abstract ideas and common phantasms are essentially alike or, at the most, described as different degrees of one and the same faculty of abstraction. Dr. Forel even calls a universal idea "a general *sensory* idea" "like the idea 'ant enemy'"[2]); and Ladd, who is one of the least offenders in most of his philosophical views, deplores the fact that "much confusion has always arisen in psychological discussion on account of the very natural use of the word 'idea' for both the concrete sensuous image and the concept or product of thought" [3]).

What, then, is a *common phantasm?*

When, before sunrise, a fisherman unmoors his boat in the pleasant anticipation of a rich haul, his imagination is naturally enough occupied with the picture of a fine fish. In spite of the general resem-

[1]) Richard F. Clarke, S.J., Logic, ed. 3., p. 123.

[2]) Ants and Some other Insects, (Religion of Science Library) No. 56, p. 22.

[3]) l. c., p. 378.

blance to the fishy tribe this imaginary fish is altogether void of any universality, and represents merely an individual fish. Let us try to eliminate the qualities in which it differs from other fish and bring out those which it has in common with them. Can this image now be called universal? Or must we not concede, that in spite of a great similarity with fish in general the image is still concrete and individual? It may be that the discriminating marks are less prominent, but the common marks of all fish, as form, color, fins, are still, as it were, in the foreground of our imagination. The image is and remains the representation of an *individual* fish. We may make as many efforts as we like, as long as the fish remains a product of our imagination we can never deprive it of *all definite shape* and *color*, and *of definite extension*. "I can consider," says Berkeley, "the hand, the eye, the nose, each by itself abstracted and separated from the rest of the body. But, then, whatever hand or eye I imagine, it must have some particular shape and color" [1]). As long as the representation of an object possesses color and extension it is not universal. What inference have we to make from this conclusion? It is this, that *there are no real universal phantasms*, and that the abstractive faculty of the imagination consists merely in the weaker or stronger representation of sensitive perceptions.

The *common phantasm*, either as an act or the representation of an object, *is and remains individual.* Or, as Clarke has it: "The common phantasm is not really common at all. It is simply an individual

[1]) Michael Maher, S.J., Psychology ed. 4., p. 236.

phantasm, rendered so vague and indistinct by the separation from it of its distinguishing characteristics that it will stand just as well, or just as badly, for one individual as another". [1])

The case is *very different* with *universal ideas.* It is true, that they are so closely connected with common phantasms that we are unable to form a universal idea without beginning with the perception of the senses and without being accompanied in our mental activity by phantasms of the imagination. Nor do we deny that the common phantasm by a kind of analogous universality bears some resemblance to the corresponding universal idea. Nevertheless, they are very different in their real nature.

In what does this difference consist?

As every one concedes, the propositions: "the angles of a triangle are equal to two right angles, the cow belongs to the vertebrates, man is mortal," involve universal ideas. For when pronouncing these truths we do not restrict them to any particular triangle or cow or man, but to all triangles, cows and men without exception and in the very same sense. Now, what must and what must not be attributed to these universal ideas, in as far as they are opposed to the corresponding common phantasms? To say nothing of less important distinctions, as the sharp and precise clearness of the idea and the vague obscurity of the common phantasm, the *main* difference lies in the fact, that the *universal idea is really and essentially universal* and *free from any definite extension*, whilst the *common phantasm*, even when it is so "universal"

[1]) Clarke, l. c., p. 137.

as almost to vanish from our imagination, *still retains a definite extension*, and remains essentially individual. The universal concept of a man or a triangle can be applied not only to a redskin or a negro, not only to this or that triangle, obtuse or equilateral, but to all men and all triangles without any exception, whilst the phantasm of a triangle even in the most extreme case can never be *identified* with any other triangle. It even disappears from our imagination, if we eliminate its sides of a definite length, its obtuse or acute angles. But the universal idea of a triangle is independent of all this. It can be identified with any existing or possible triangle, even if the latter be so large that its three vertices rest on three different fixed stars, or so small that we can perceive it only by means of a microscope, if its sides be green or blue, its angles obtuse or acute. These are merely *casual* differences, and do not affect its *nature* as a triangle. The universal idea expresses that which constitutes a being, denotes its essence, its nature, whilst the picture in the imagination merely represents a being, colored in such and such a way, of this or that extension. The color and extension of things, even of one and the same class, may be different; *but the nature of things must be the same in all.* A man deprived of his essence, of that which makes him what he is, would no longer be a man, and a triangle no longer a triangle. Still, we do not wish to say that the universal idea of human nature exists in the *same* way, that is, as universal, in every individual human being. That is the error of the ultra-realists. Every finite being that exists, or can be called into existence, is necessarily

individual and realizes the universal idea of that being in its own way. Every human being is a man, but never the *same* man. My own individual human nature is not identical with the individual human nature of anybody else. But we do want to say that *every finite essence can be deprived of its individuality by abstraction; that by this process we attain a universal idea*, the so-called metaphysical essence of the Scholastics, which is one and the same, and can be predicated of every individual being belonging to that class. "The physical is not the same, but perfectly alike in all; the metaphysical essence is nothing else than the physical essence inadequately conceived by us." Nor is this universal idea a *mere* fiction of the mind. It is based on the perfect likeness of individuals of the same essence. In forming it, our mind does not produce but *presupposes this perfect likeness* as something entirely independent of all intellectual activity.

For all men, no matter what their stature, color, and so forth may be, are true men and have what we call a "human nature"; and all triangles possess, as a matter of fact and independently of the mind that which makes them triangles. The *only* thing that the intellect produces is the *universality as such.* For the intellect has the power of perfect abstraction. It is capable of omitting all differences between the objects under consideration, including that property which makes every object individual, and of conceiving or retaining merely what is truly common to all of them.

What, therefore, is the true nature of the universal idea and the common phantasm?

Both are acts of the mind and as such they are individual, just as any other existing object or property. But, in as far as their objective contents are concerned, that is, in as far as they are representations of objects, the common phantasm is and remains individual and extended, while the universal idea is universal and inextended, even though the object in its actual state of existence possesses the quality of extension. For, as long as we do not eliminate any and every vestige of extension, the representation of the object is devoid of the character of universality. *True universality absolutely demands that even the last trace of individuality disappears.*

What, therefore, is our answer to the question: Is a sensitive faculty able to form general notions?

It must be negative. For as one of our best psychologists puts the argument: "We are capable of apprehending and representing to ourselves abstract and universal ideas. But such operations could not be states of a faculty exerted through, or intrinsically dependent on, a bodily organ. A power of this kind can only react in response to physical impressions, and can only form representations of a concrete character, depicting contingent individual facts. But, universality, possibility, logical sequence, general relations, do not constitute such a physical stimulus, and consequently could not be apprehended by an organic faculty. Consequently these higher mental functions must be admitted to be of a spiritual character; they thus transcend the sphere of all actions depending intrinsically or essentially by their nature on a natural instrument." [1])

[1]) Maher, l. c., p. 471.

In other words: *A sensuous faculty* is by its very nature *extended*, and can represent only *extended objects. But universal ideas as such are completely independent of every vestige of definite extension. Therefore, a sensuous faculty is unable to form general ideas.*

What is the necessary conclusion?

Perhaps that there are no universal ideas? But the foregoing explanations prove that this is absurd. *With logical necessity*, therefore, and *not* because "some peculiar bias has influenced our philosophical views", we have to assert that any one who is able to form universal ideas by abstraction must be endowed with a faculty which *trancends* the power of the senses, with a faculty capable of representing inextended objects, and extended ones in an inextended manner. In other words, the cognition of universal ideas is inseparably connected with a *supersensuous*, *immaterial*, *spiritual intellect.*

Perhaps many an adversary will reject this conclusion, because it leads with inevitable necessity to the acknowledgment of a spiritual soul in man, which, even in the eyes of so eminent a scientist as Emery, is a mysterious being, whose existence man may recognize or deny, according to his views of the universe and of the nature of man.

But, if a spiritual faculty is necessary to form universal ideas, it is equally necessary to act with consciousness of finality; for, as we have proved, this consciousness implies universal ideas. Again, as "purpose," supposes consciousness of finality, there can be no action directed by "purpose" without a spiritual

faculty. Herewith we have proved our definition that *intelligent activity involves essentially a perfect consciousness of final tendency, and is guided by a purely spiritual cognition and appetite.*

What, therefore, is the *essential criterion* of distinction between instinctive and intelligent activity? *An intelligent action implies necessarily consciousness of finality, whilst an instinctive one does not.* Does this criterion postulate an *essential difference?* Yes, *an instinctive action is of a sensuous, an intelligent act of a spiritual character.*

PART II.

ANIMALS HAVE NO INTELLIGENCE.

CHAPTER VII.

The "Intelligence" of "The Lower Animals".

IT is true, that most modern naturalists, as was mentioned before, deny the difference in quality between the human mind and the animal soul which is strenuously upheld by Catholic philosophy. They consider themselves and their ideas as a "product and a subject of universal evolution". "Surely," as Professor W. M. Wheeler says, when commenting on Wasmann's views, "the sciences of comparative physiology, anatomy and embryology, not to mention paleontology, distribution and taxonomy must have been cultivated to little purpose during the nineteenth century, if we are to rest satisfied with the scholastic definition of ratiocination as an adequate and final verity. And surely no one who is conversant with modern biological science will accept the views that the power of abstract ratiocinative thought, which is absent in infants and young children, scarcely developed in savages, and highly developed and generally manifested only in the minority of civilized men, has miraculously (!) sprung into existence in full panoply like the daughter of Jove." [1])

[1]) The American Naturalist, vol. XXXV (1901), p. 873.

We fail to see how the results of the sciences enumerated by Prof. Wheeler could ever change the definition of intelligence developed in the preceding pages, since that definition rests on totally different grounds and belongs to a sphere which even a science like physiology can only approach, but never reach. The fact that intelligent actions can only proceed from an inextended spiritual faculty is indeed a final verity, which, it is true, may find a much deeper and more adequate explanation as true human psychology advances, but which will never be changed in the point it emphasizes.

We have seen in the first part of this essay that the *essential criterion* for discriminating instinctive and intelligent actions from each other lies in the fact *whether or not the animal evinces consciousness of the finality guiding its actions.* This criterion we shall apply in our present investigation, which proposes to show that *neither the lower nor the higher animals betray the slightest vestige of intelligence.* "High animals" are distinguished from "low animals" by the fact that the bodies of the latter are less differentiated than those of the former. Practically the distinction will coincide with the division of the animal kingdom into invertebrates and vertebrates.

In order to establish the proposition that the lower animals are void of intelligence we propose to enter upon a most remarkable psychic contrast observed in the life-history of two ant-species, Polyergus and Formica sanguinea. The latter easily holds the first place among all ants and, in general, among all lower animals. This fact is freely granted by the best observ-

ers of ants. Some even, as Sir John Lubbock, maintain that in a certain sense the Formica sanguinea stands next to man. Hence, to substantiate the proposition that the lower animals are void of intelligence, it is but necessary to prove that this famous ant does not possess any higher faculty than mere animal instinct. Another reason, why we give preference to ants as subjects of our inquiry, is because the actions of no other animal have been so much misinterpreted for upholding the doctrine of animal intelligence.

This is especially true of the ant-species Polyergus, which we have selected as first example. [1])

It is a warm sunny day in June. In a colony of the *Polyergus rufescens* (Plate III., Fig. 1) feverish activity is displayed. The Amazons (this is their popular name in Europe), having spent well nigh the whole morning in preening their legs and feelers, rally upon their battlements, that is on the top of their nest, and with great haste and evident excitement descend for a warlike expedition. Within about 50 paces of their castle there is in a meadow a settlement of the *Formica rufibarbis.* Already some time before some roving members of the Polyergus household have accidentally hit upon this formicary, and now under their guidance a goodly array of about 1000 "slave-hunters" may be seen marching in an almost straight line upon their destined prey. Having arrived within 10 cm. of the enemy's stronghold, the vanguard comes to a stop, giving a violent signal with their feelers to the ranks immediately behind them. With in-

[1]) The following description was originally published in the Scientific American Supplement.

credible rapidity a number of emissaries hurry through the main body of the army, and in less than 30 seconds the forces are ready for the attack. In a twinkling they scale the walls of the *F. rufibarbis* bulwark. With indescribable celerity the Amazons fall upon their enemy. And there we may behold a twofold spectacle. While one part of the Polyergus warriors is murdering the defenders of the hostile nest, the other and greater part is rushing through every opening into the interior of the enemy's citadel. Some minutes have passed. A double stream of ants is issuing from the interior of the nest. Both are loaded down with cocoons, the "papooses" of ants, one consisting of *F. rufibarbis* endeavoring to save what may be saved, the other of the Polyergus troops hastily returning with their booty. There is no useless shedding of blood. The crania of the *F. rufibarbis* are trepanned only in so far as they refuse to yield up their progeny. Suddenly the scene is changed. The *F. rufibarbis*, noticing the hasty flight of the ravishers, at once pursue them to make them give up their precious burden. There is a fierce pulling and struggling hither and thither. The *F. rufibarbis* plunge their mandibles into the legs and feelers of the Amazons and cover them with venomous ejections from their abdomens. But only some of the Amazons' rearguard are constrained by superior numbers to deliver up the ravished cocoons, while one or the other of their warriors remains a corpse upon the field. In about ten minutes everything is over. The scattered *F. rufibarbis* forces return to their dwelling to restore everything, if possible, to its pristine state. The stolen cocoons, however, are handed over by the Polyergus to their slaves, already present in the nest,

for further care and development, or for consumption. They themselves again squat on their four hindlegs, to renew their comical cleaning operations, which they interrupt only to extort food from some passing slave. The young ants, which are fortunate enough to come safely out of their cocoons, are in reality not treated by the colony as slaves (which in this case is a wrong appellation), but as full-fledged citizens. However, it is their lot, at least in the nests of the Polyergus, which are unfit for any work, to take upon themselves the construction of the nest, the rearing of the brood, and the victualizing of the whole community. And this task they undertake with masterly skill and rare devotion. Entirely forgetful, as it were, of their home and kindred, they are absorbed in caring for strangers. They are unconcerned even about the propagation of their own species, they sacrifice that for which animals strive to the utmost merely in order to preserve the race of their oppressors, which would otherwise be doomed to certain destruction.

This is the exterior appearance of one of the most splendid expeditions ever observed by Huber, Forel or Wasmann, and certainly the fact narrated seems to betray a high degree of intelligence. For, first of all, by their warlike expeditions the Amazons seem to intend to supply their household with new auxiliaries. Moreover, the means applied for the purpose are most appropriate. "Scouts" have explored the hostile nest and seem to lead the whole army. At the right moment the signal for the attack is given. The attack itself takes place on a sudden, with great celerity and by all at once. Thus the enemy will be surprised and

the number of cocoons captured will be more considerable. No blood is shed without purpose. Moreover, the Polyergus seem to distinguish very well between the useful cocoons of workers and the useless and harmful ones of the females and males. Finally, the ants apparently succeed in determining their slaves to desist from the care of the preservation of their own species, and to devote all their strength, yea, even their very life, for the benefit of the colony and the progeny of their ravishers.

These few facts, indeed, seem to throw a brilliant light upon the psychic faculties of the ants; and though some of them may be explained by very simple processes, there are scarcely any others in the life-history of animals which present to us a more intellectual appearance. The question now arises: Must these facts in reality be attributed to true intelligence; do they really involve true consciousness of finality? A short consideration of the dark side in the life-history of these very same ants will convince us that this question cannot be answered in the affirmative without evident contradiction.

As will be known to many of our readers, the mandibles of the Amazons are of a peculiar construction. They are not like those of other ants adapted for many functions necessary to sustain the life of the individuals and commonly exercised by those organs (Plate III., Figs. 2 and 3). Hence the Amazons essentially depend on the assistance of their helpmates in many of their actions. This essential dependence goes so far that throughout life the Polyergus are even nourishedby their slaves. This fact is

PLATE III

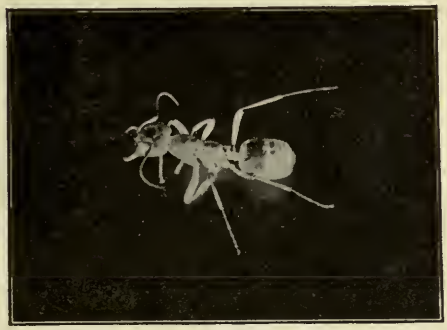


Fig 1.—A Polyergus (Polyergus bicolor Wasm.) (Original.)

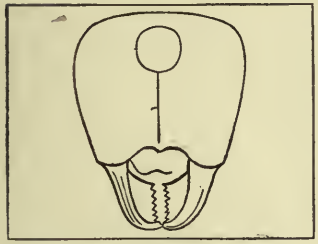


Fig. 2.—Head and Mandibles of a Formica seen from Below. (Original.)

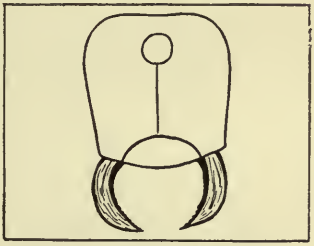


Fig. 3.—Head and Mandibles of a Polyergus seen from Below. (Original.)

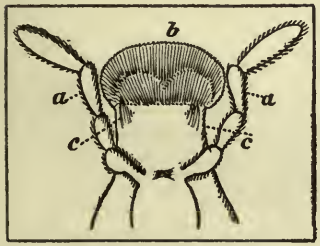


Fig 4.—Lower Lip of a Formica (labium). (Wasemann.) (*a* = labial palpi ; *b* = ligula; *c* = paraglossæ.)

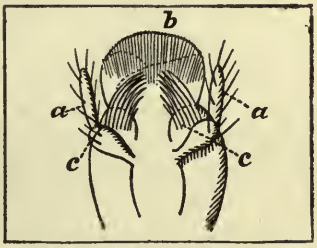


Fig. 5.—Lower Lip of a Polyergus. (Wasmann.) *a* = labia lpalpi *l* = ligula; *c* = paraglossæ.)

sufficiently established by the observations of Huber, Lespeo, Forel, Adlerz, Wasmann, etc.

The writer, too, had occasion to verify the same with regard to *Polyergus bicolor* Wasm., a newly discovered American Amazon. The process of feeding takes place in the following manner. The hungry Polyergus first violently buffets and strokes with feelers and forelegs the head of a passing slave. If the slave has sufficient food in its little crop, it causes a drop of the prepared liquid to appear on its lower lip, where it is licked off by the Amazon. Now it is certainly a very rare case that an animal so much depends on others that it must even be fed by them during its whole existence. And thus the two interesting questions present themselves: First, what will happen to the Polyergus if deprived of their slaves? And secondly, are they at all able to obtain food independently of any exterior aid? As to the second question, Wasmann sums up the results of a minute examination of the Amazon's mouth-parts in the following statements: 1. By the construction of their mouth-parts, and especially by the shortness of their palpi, the Amazons show, indeed, that they are less adapted for independent feeding than other ants related to them (Figs. 4 and 5). 2. There is, however, no organic impossibility in the way of their independent nutrition. For other ants with organs not less imperfect feed themselves without being assisted by others. 3. The structure of the so-called paraglossæ seems even to indicate that the Polyergus are able to obtain food in an extraordinary manner (Figs. 4 and 5). Yet these inferences from the construction of the mouth-

parts of the Polyergus would in themselves not be sufficiently warranted, unless actual experiment had corroborated them. Examining the mandibles of the Polyergus, we find that on the interior side they have a slight excavation widening toward the head (Fig. 1). But as the Amazons are endowed with great predatory instinct, they take delight in exercising their mandibles upon their foes; and if then these organs happen to be inserted into the body of ants or their cocoons, the channels contained in them convey the liquid to the lower parts of the mouth. Now Wasmann with sufficient frequency observed the following fact: While the mandibles of a Polyergus, having pierced the body of an enemy, were resting quietly in the same position, their palpi and lower lips were moving in regular intervals toward the inside, this movement lasting from three to five minutes But precisely this motion of the palpi and lip constitute the eating operation of ants. Moreover, Adlerz, Wasmann and the writer himself have noticed how in observation nests Polyergus accidentally coming into contact with the glass panes of the walls licked off the drops of precipitation found upon them. From this it follows that the Polyergus are actually capable of independent nutrition. What should we, therefore, naturally expect of them, if they are robbed of their slaves? Most assuredly that impelled by hunger they would make use of their power of eating and would make an independent effort to partake of the food placed before them. But what are the actual facts? The result of numberless experiments is the following: Although the Polyergus are able to eat and accident-

ally do eat now and then, they must absolutely be fed by their slaves, if they are to remain alive. You may prepare for them the most pleasant dwelling and the most exquisite nourishment; if you neglect to provide them with slaves, they are doomed. Their desire for nourishment impels them only to seek it from their slaves, but never to make an attempt at independent nutrition. Therefore, this ant apparently so intelligent in its warlike operations, is so abnormally stupid and helpless in private life, as not to be able to establish the simple relation between the promptings of appetite and independent nutrition, and prefers death to making use of its faculty of eating. But a being that is capable of eating and from experience knows how to eat, yet even in the greatest necessities with unexceptional regularity, prefers to die than to eat independently, is a rather poor specimen of ant intelligence. There can be no question here of some error of judgment, as may occur in man endowed with intelligence. Real error cannot be a normal occurence; it is never found in all individuals of the same species; it cannot be committed, unless there is at least some appearance of truth and some influence of passion or prejudice. Regarding the actions in question, however, all the circumstances point not to an accidental error, but to an entire absence of intelligence. For in the first place, these actions are entirely useless for the individuals performing them. Secondly, they occur with all the individuals so far observed both in Europe and in America. Finally, there can be no question of the influence of their will under the stress of some passion or predilection. For

every natural desire would prompt them to do the opposite. Thus we are forced by inexorable facts to deny to the great warrior ant, the much lauded Amazon, the faculty of acting with the consciousness of final purpose and to assign her a place in the realms of mere animal instinct.

The second psychic contrast, which strongly conroborates the conclusion suggested by the first, is taken from the life-history of Formica sanguinea. This ant, it is true, does not exhibit the brilliant intrepidity characterizing the warlike expeditions of the Polyergus. According to Forel sixty amazons can put to flight thousands of the Formica sanguinea. Again their warlike tactics do not present the same certainty and unity, at least not if there is question of more populous slave-nests. Finally the number of expeditions, in the case of the Polyergus about 44 in 33 days with a result of 40,000 cocoons, is in the case of the Formica sanguinea comparatively insignificant. But in spite of these facts, which are partially due to the independence of the Fornica sanguinea from its auxiliaries, some features in the expedition of this ant exteriorly seem to indicate a superiority in psychic endowments. We mention only a single instance. Whilst Polyergus makes its attack in serried ranks and with all the forces actually engaged in the expedition, Formica sanguinea uses only a part of its troops for purposes of assault. The rest, as if intending to blockade the hostile formicary, distribute themselves in squadrons around it. If, then, the inhabitants of the nest try to save their young by flight, they are at once pursued and captured by the outlying posts. It is evident that this

procedure is admirably adapted to secure the desired cocoons. For the nest of Formica fusca, the principal auxiliary of Formica sanguinea, is in most cases not very large, and its inhabitants are cowards, at least if alone. Thus it happens that a few of the Formica sanguinea are sufficient to bring about a universal flight. If, consequently, Formica sanguinea would not divide its army, but make its attack with all the forces, this kind of action would not only waste the strength of the aggressive power, but also most probably result in little success. For, ere the Formica sanguinea could have succeeded in reaching the interior of the hostile nest, the majority of the fleet-footed Formica fusca would most probably have left it.

But, however imposing the wonderful array of the apparently intelligent actions of the Formica sanguinea may be, it can be easily shown that there is no more intelligence in them than in Polyergus. For the purpose of proving this statement we intend to refer to the *relation existing between the Formica sanguinea* and one of its favorites, *the beetle "Lomechusa strumosa."* This most interesting relation was discovered and described by Eric Wasmann, S.J., [1]) and has of late been verified with reference to the respective rep-

[1]) Of the numerous publications of E. Wasmann, S.J., on this subject, we mention especially "Vergleichende Studien ueber das Seelenleben der Ameisen und der hoeheren Tiere" (Herder), 2d ed., 1900. Moreover, "Die Ergatogynen Formen bei den Ameisen und ihre Erklærung," Biologisches Centralbl., XV., pp. 606-646, and "Neue Bestætigungen der Lomechusa-Pseudogynentheorie," Verhandlungen der Deutschen Zoologischen Gesellschaft, 1902, pp. 98-108, etc.

resentatives of the two European species in America.

Let us see in what this relation consists. It is the custom of the Formica sanguinea not only to adopt related species of ants as their auxiliaries, but also to receive a number of other insects, notably the Lomechusa strumosa, as genuine guests into their household. This hospitable relation between ant and beetle is based on various reasons. Unable to raise its own brood, the Lomechusa has the instinctive desire to have itself and its young fed by the Formica sanguinea. On the part of the Formica sanguinea the relation to its guest is based in part on the circumstance that its maternal instinct is aroused by the sight of the helpless beings before it. Then, by active and passive mimicry, the Lomechusæ imitate the attitudes and behavior of their hosts and furnish them some pleasurable sensations for their gustatory and olfactory organs. Besides, in order to understand the facts to be explained presently, we must remember that there are four distinct periods in the life-history of beetles and ants. Not unlike our birds, the young offspring passes the first days of its short-lived existence in the dark and narrow enclosure of the egg. Scarcely has the baby-beetle escaped from its precious enclosure, when it starts upon the second most precarious period of its life. A tiny mass of pulp, the helpless creature, now called larva, lies in the nest of the ants. Totally dependent on their "loving care", it ever and again opens its mouth, to be fed by its "kind" host. After its bodily size has assumed the proper proportions, the larva is carried by the ants to a suitable place and covered with earth. In its temporary

grave, however, it does not return to dust, but having spun a dense web or cocoon around itself, it soon changes its bulky form into the so-called pupa, indicating in more or less distinct outlines the form and structure of the future beetle. Finally, the periods of development come to an end. The pupa tries to extricate itself from the narrow confinement of its little house and makes its appearance as a lively beetle, somewhat smaller than represented in the accompanying illustration (Plate IV, Fig. 1).

Now, in supporting its guest, the Formica sanguinea, as a rule, commits *two blunders* betraying such a *profound stupidity* as to furnish us very clear proof that in those ants not a trace of consciousness of final tendency can be found.

For, *in the first place*, through the hospitality accorded to the Lomechusa, *the Formica sanguinea* bring about *the ruin of their colony and the gradual extinction of their species.* This is done in a *twofold* way.

(1) There is perhaps no animal which cares so much for its young as does the ant. For no sooner is the nest attacked than its inhabitants before all else hurry off with their tender young to a place of security. And not unfrequently they suffer themselves to be deprived of head and limb rather than deliver up the larvæ to the enemy. Even if placed in a vial filled with alcohol, they may often be found still holding the dead larvæ between their mandibles. And yet, what a strange spectacle do we behold! The ants which were wont to defend their young with so much enthusiasm and bravery have undergone a com-

plete change. Ever since that strange guest entered the nest and deposited its eggs, all the care of the ants is lavished upon the brood of the intruder, which manifests an almost fabulous appetite and grows with great rapidity. To satisfy the hunger of their "beloved" guests, the ants even allow them freely to devour their own eggs and larvæ, otherwise so precious to them; yea to hasten the work of destruction, they themselves carry the larvæ of the Lomechusæ to the places where the eggs and the larvæ of the ants are stored up.

Whence this strange phenomenon? Year after year passes by. The conditions of the flourishing colony become more and more threatening. But the "most intellectual" ant is *unable to see* that its action must necessarily result in the *final ruin of the ant-colony and species*, and this the more so since the beetles are quite numerous and their appetite most voracious.

(2) Nor is this all. To the rearing of the Lomechusa by the Formica sanguinea it is also due that in the colonies of the latter an abnormal form of ants is produced, which in the course of time must necessarily do additional damage to the colonies and species of the Formica sanguinea. These abnormal forms are called "ergatogynes," a word which according to its Greek origin (ἐργάζομαι = to work, γυνή = female; partly worker; partly female) fitly characterizes them. Wasmann distinguishes six different forms, the most important of which are the so-called pseudogynes (ψευδής = false) (Figs. 2-4). These animals are evidently ruined existences. Unable, either to lay eggs

PLATE IV

Fig. 1

Fig. 2.
a
b c

Fig. 3

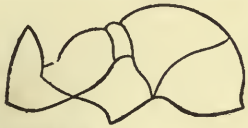


Fig. 4

EXPLANATION OF PLATE IV.

Fig. 1.—*Xenodusa cava* Lec. (original). Fig. 2.—*Formica sanguinea* subsp. *rubicunda*, Em. a — female; b — *pseudogyne;* c — normal worker (original). Fig. 3.—Thorax of a normal worker of *F. rubicunda* (original). Fig. 4.—Thorax of a *pseudogyne* of *F rubicunda* (original).

or to discharge the functions of workers, they are useless members of the ant community and must finally effect a degeneration of the entire species of the Formica sanguinea. Now Wasmann has shown by a great number of facts, that the existence of these pseudogynes must be ascribed to the rearing of the guest Lomechusa. [1]) As regards the explanation of this phenomenon nothing certain has as yet been ascertained. Wasmann is of the opinion, as we have stated elsewhere, that the repeated rearing of the beetle causes a gradual change in the brooding instincts of the ants, so that the pseudogynes are but a developmental stage of such larvæ as were originally destined to become females, but were in the course of their later development transformed into workers. Be this as it may, the fact that these encumbrances on the commonwealth come into existence and multiply with such rapidity, is the fault of the Formica sanguinea itself. We should expect, therefore, that at least this circumstance would rouse the attention of the ants and make them realize the deplorable condition of their colony. But no! Instead of murdering their hostile guests one by one, they continue to give them their best attention, to sacrifice for their sake hundreds of their own offspring and to make out of the rest degenerated creatures,— good for nothing. And *not one* of the numerous inhabitants of the various colonies *becomes aware of these*

[1]) How far the very same may be proved for the corresponding American species we have shortly explained in our paper on "Formica sanguinea, subsp. rubicunda, Em. and Xenodusa cava Lec, etc.," *Entomological News*, December, 1904.

most senseless and self-ruining actions. Is not this a clear indication, that there cannot be any trace of true consciousness of finality in them? Or, could we imagine an entire class of beings endowed with intellect taking delight in overcoming the strongest impulse of nature in spite of innumerable and most disastrous losses? But this is only the first stupid action of the Formica sanguinea. The second is no less flagrant, and when combined with the first leaves no doubt whatever as to the *total absence of an intellectual faculty* in ants.

The *second blunder* committed by the Formica sanguinea in the rearing of their guests consists in this that, notwithstanding their excessive tenderness towards the Lomechusa, *the Formica sanguinea are continually active in exterminating not only their own brood, but also the brood of their guests.* For, the larvæ of beetles require a treatment totally different from that needed by the ant larvæ. Scarcely have the latter, toward the close of their larval stage, been embedded in the earth, when they envelop themselves in a close and firm cocoon. There is, consequently, no difficulty in their being soon after extracted again from the earth and carried about at will by their fellows. But this stereotype procedure is *entirely unsuitable* for the young Lomechusa. For these spin only a thin silken cocoon, requiring exceedingly gentle handling and sure to tear whilst being extracted from the earth. Hence, to drag the cocoons to the surface before the pupae are completely formed, is evidently out of place. And yet, *despite their strong affection for their guests*, and *despite all possible experience*, the *For-*

mica sanguinea year after year fall into the same senseless "error" and *can neither see nor learn*, that their guests require a different breeding from that of their own offspring. True, after having torn the cocoons of their darlings, they carefully replace them in the earth. But is it perhaps to grant them now the necessary rest for transformation? On the contrary! The same process is repeated, until the larvae wither and die. But if through the carelessness of their hosts some larvae succeed in reaching their pupal stage, even then they are often brought to the surface, to be eaten up by their anxious nurses in an *excess of affection!*

In the *first place*, then, the Formica sanguinea are so foolish as to lavish their care upon the Lomechusa with the result that their own brood is distroyed and their species degenerated. *Secondly*, they refuse to give to their darlings the necessary time and rest for their development, exterminate them by an inappropriate treatment and finally devour them in their pupal stage.

But *these two facts present many and insoluble difficulties* in the way of ascribing to the ants the faculty of recognizing the appropriateness or inappropriateness of their actions. For, no matter from what point of view we consider the case, we cannot help but find *an unfailing and evident contradiction.* If one should say that the Formica sanguinea lavish such tenderness upon their guests, because the latter afford them some sense-gratification, we ask: If this be the case, why do they exterminate and devour the young Lomechusae and thus frustrate the accomplishment of such

a purpose? But if it be rejoined that the Formica sanguinea exterminate the Lomechusa because of the damage inflicted, we ask: Why then do the Formicæ sanguineæ bestow such care upon their guests, as to neglect and sacrifice their own colony, their offspring and their species?

Thus the life-history of the Formica sanguinea, "the most intellectual ant", affords an example of how *from a more universal contemplation* of ant-life, we are necessarily led to adopt conclusions quite different from those reached by certain "pseudo-psychologists" of our day. Of course, it is still a mystery, in what manner the single actions proceed from instinct. For on this point the analogy between animal and man, from which we must always proceed, becomes more remote the further we "recede through the animal-kingdom downwards from man." Still the fact remains, that the faculty by which the activity of ants is to be explained is not intelligence, but instinct, and on this very point analogy retains its full force. But if evident contradictions are to be avoided, this instinct is not to be conceived as the power of mere automatic reaction, but rather as a faculty guided by sensuous cognition and modifiable within the limits of this cognition by external experience.

The high degree of objective finality which is manifest in innumerable actions of the Formica sanguinea does not proceed *as such* from the ant itself, but from God's eternal Wisdom. That Wisdom, too, can alone account for the double play of stupidity which we have explained above. For, as Wasmann profoundly remarks: "That supreme Wisdom which

has made use of the senseless 'love' of the Formica sanguinea towards the Lomechusae and their larvae to keep the propagation of the ants within due limits, has made use of the same senseless 'love' of the ants to prevent the excessive multiplication of the beetle. Such are the mild and yet powerful measures, by which a divine Wisdom is able to preserve the equilibrium in nature, animal intelligence and animal-morality standing before such phenomena in impotent perplexity."

Chapter VIII.

The "Intelligence" of "The Higher Animals".

We now pass over to some striking proofs in support of the fact that the proposition which we have defended with reference to the "most intellectual" of the lower animals applies equally well to the "most intellectual" individuals of the so-called higher animals. Our observations are based principally on some of the clever experiments which Prof. Thorndike and others made with dogs, cats, and monkeys under the most favorable circumstances. We could, of course, adduce similar instances against the intelligence of the higher animals, as we have explained in the proceeding chapter. We could remind our readers of that wonderful dog which, being deprived of her young, lavished her maternal ministrations on a pair of old slippers; or of those loving apes which adopt other animals, defend and caress them and clean them of their fleas, but let them die the death of starvation. Our proof against the intelligence of animals would be even more cogent than the one furnished by Mr. Martin, the able editor of a voluminous work on "Natural History", in favor of animal intelligence. Says the worthy Darwinist: "When visiting the zoological garden in Berlin I perceived how the beginnings of a human smile really played on the

almost humanlike visage of the Chimpanzee." [1]) But we prefer to make use of the *strictly scientific experiments* of Prof. Thorndike, firstly, because they are very simple and entirely free from any subjective element; secondly, because they admit of no doubt whatever as to the reality of the facts as well us to their interpretation.

For many reasons Prof. Thorndike finds fault with most of the modern books on animal intelligence. These books, he says, do *not* give us a *psychology*, *but* rather a *eulogy of animals*. They have all been about animal intelligence, never about animal stupidity. Moreover, according to him, the facts have generally been derived from *anecdotes* which give really the abnormal or supernormal psychology of animals. Finally, even with good observers often only a single case is studied, the conditions of the case are not perfectly regulated, and the previous history of the animal in question is not known. Hence there is no sufficient reason for generalization, nor can the influence of previous experiences be estimated. All these various faults Thorndike wishes to avoid, and in our opinion he has succeeded admirably.

[1]) "Illustrierte Naturgeschichte der Tiere," Leipzig, 1882, p. 11. It is, of course, evident at what Mr. Chimpanzee really smiled! Many authors like Martin maintain that monkeys use sticks and stones as weapons and give similar evidence of intelligence. *This is not so.* No less an authority than the editor of the third edition of Brehm's "Tierleben," Mr. Pechnel-Loesche, who has made most careful observation to this effect in the southwestern part of Africa assures us that, as a matter of fact, monkeys "never do such a thing". *Animals do not understand the use of tools.*

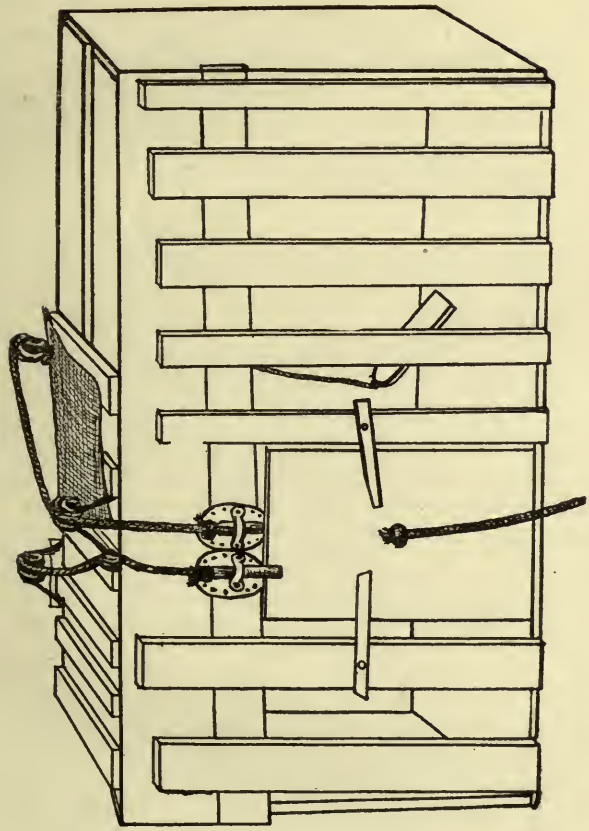
Let us see. The following is the ingenious method of experimentation he adopted. He took a good number of dogs, cats, and chicks, and having deprived them of food for some time, put them in enclosures from which they could escape by some simple act, such as pulling at the loop of a cord, pressing a lever, or stepping on a platform. A model of a box used in the experiments is given in the accompanying drawing (Plate V). Food was left outside in sight of the animal. *The animal*, then, *had to form in each case some few simple associations between the representation of the interior of the box and the various movements which would enable it to satisfy its hunger.* The observer made sure that the animal was free from his influence and had never been subjected to the same or a similar experiment. Moreover, the animals were healthy, the main data of their life-history were known, and they all were in the same *state of absolute hunger* when subjected to the experiment.

Now, what are the results of Thorndike's experiments? As far as they pertain to the present subject, *they prove, in the first place, that dogs and cats are unable of themselves to form associations which imply the understanding of the finality of actions.* For if they succeeded in opening the door of their cage, they succeeded BY ACCIDENT, *not by intellectual inference.*

Let us give one typical example. The successes and failures of two cats, No. 1 and No. 6, are expressed in the following table: [1])

[1]) l. c., p. 45.

PLATE V.



The model of a box used by Mr. Thorndike in his experiments. (Dimensions about 20 inches long, 15 broad, 12 high.)

No. 1.			No. 6.		
	13.00	Failed.		17.50	Succeeded.
	9.30	Succeeded.		3.30	"
	1.40	"		9.00	"
	.50	"		2.10	"
	15.00	"		1.45	"
	6.00	Failed.		1.55	"
	14.00	Succeeded.		13.00	"
	20.00	Failed.		5.00	"
	4.30	Succeeded.		2.30	"
	20.00	Failed.		15.00	"
	20.00	"		10.00	Failed.
	15.00	"		5.00	Succeeded.
	60.00	"		15.00	Failed.
				10.00	"
				10.00	"

The figures in the columns represent the time (in minutes and seconds) the animal was in the box before being taken out if it failed to escape. Double lines represent an interval of 24 hours.

"Surely", Mr. Thorndike says, "if one and six had possessed any power of inference they would not have failed to get out after having done so several times. *Yet they did.* If they had even once, much less if they had six or eight times, inferred what was to be done, they would have made the inference the seventh or ninth time. And if there were in these animals any power of inference, however rudimentary, however sporadic, however dim, there should have appeared among the multitude some cases where an animal seeing through the situation, knows the proper act, does it and from then on does it immediately upon being confronted with the situation . . . *Now the*

scores of cases recorded show no such phenomenon. The cat does not look over the situation, much less think it over, and then decide what to do. *It bursts out at once into the activities which instinct and experience have settled on as suitable reactions* to the situation, 'confinement when hungry with food outside.'" [1])

The *second* fact which is brought to undeniable evidence by Mr. Thorndike's experiments is the following: *Animals are incapable of learning by imitation such associations as would imply on their part the understanding of the finality of actions.* Of the many experiments which Prof. Thorndike describes we mention only one or the other.

Eight *chicks* were successively put in a box, where they were left alone from sixty to eighty seconds. Then another chick which knew how to get out was introduced with each of them into the box, and upon its performing the act both were allowed to escape. No cases, as Thorndike expressly states, were counted unless the imitator *clearly saw* the other do the thing. Besides, it was evident, that the imitators wanted to get out when left alone. The result of the numerous experiments is as follows: Chick No. 84 saw its companion escape 129 times, but failed completely to imitate it. Similarly chick No. 85 failed after 30 trials, chick No. 86 after 44 trials, No. 87 after 26, No. 80 after 54 trials, etc.

Only one, No. 82, performed the act: but this was accidental. Thorndike says: "I have no hesitation in declaring 82's act in stepping on the platform the

[1]) l. c., p. 45.

result of mere accident and am sure that anyone who had watched the experiments would agree." [1])

In the case of *cats* the experiment was so arranged that through a screen the cat which was to imitate another one could see its guide pull the string, go out through the door thus opened and eat the food outside. *The result was the same, as in the case of the chicks.* There was not the slightest difference between their behavior and that of those who were put into the same position without ever having seen another one escape from it. "No one, I am sure, who had seen them, would have claimed that their conduct was influenced by what they had seen. When they did hit the string, the act looked just like the *accidental success* of the ordinary association experiments." [2])

Dogs, too, completely failed to comprehend the simple idea "that what gives another food will give it to them also."

No. 3, for instance, had been found to be unable to escape from a box of himself. A chance was given him to learn it from No. 1. No. 3 could see and study every move of No. 1. And yet what was the result. Here is the record: [3])

[1]) l. c., p. 54.
[2]) l. c., p. 57.
[3]) l. c., p. 60.

Times No. 1 did the action.	Times No. 3 surely saw the action of No. 1.	Times No. 3 probably saw the action of No. 1.	Times No. 3 in box alone.	Result.
30	7	14	3 minutes.	Failed.
After 1 hour: 35	9	14	3 minutes.	Failed.
After 1 hour: 10	3	3	5 minutes.	Failed.
After 24 hours: 20, 30	6, 8	8, 13	6 minutes.	Failed.
After 48 hours: 25, 25, 25	8, 6, 9	11, 12, 7	8, 6, 10 min	Failed.
After 24 hours: 30	10	11	40 minutes	Failed.

Though No. 3 saw No. 1 surely 66 times, it failed in all cases. Prof. Thorndike explains many similar experiments most minutely. All lead to the same conclusion that *even the highest animals are absolutely incapable of understanding the finality of actions.* But Thorndike's experiments do not refer only to cats, dogs and chicks. In a special monograph [1]) on the "mental life" of three South American monkeys of the genus Cebus, published in 1901, he shows clearly that "a negative answer to the question 'do the monkeys reason?' seems to be inevitable." Very many simple acts similar to those enumerated above were not learned by the monkeys in spite of again and again having seen them performed by Thorndike and by their own kind. Similarly, "after having abundant opportunity to realize that one signal meant

[1]) "The Mental Life of the Monkeys." The Psychological Review. Monograph Supplement No. 15.

food at the bottom of the cage and another none, a monkey would not act from the obvious inference and consistantly stay up or go down as the case might be, but would make errors such as would be natural if he acted under the growing influence of an association between sense impression and idea, but quite incomprehensible if he had compared the two signals and made a definite inference." Finally "after experience with several pairs of signals, the monkeys yet failed when a new pair was used, to do the obvious thing to a rational mind; viz, to compare the two, think which meant food, and act on the knowledge directly." Certainly animals can learn to perform new and even complicated actions, but only if one succeeds in associating in the soul of each individual a *definite* impulse with the representation of a *definite* motion. Thus, as Wasmann narrates in his book "Instinct and Intelligence in the Animal Kingdom," [1]) "Lubbock's poodle Van finally learnt to 'read,' by being trained to fetch the card with the word when it was hungry." But "in spite of its long course of training . . . Van often brought the wrong card, when it was hungry. This fact shows that it never understood the relation between the graphic symbols and their meaning. Nor did it occur to Van to give 'reading lessons' to Patience, the lap-dog. Nor did Patience hit upon the idea of profiting by Van's experience, although she had often witnessed the reward which Van received for fetching the proper card."

Besides, Mr. A. J. Kinnman [2]) has applied Mr.

[1]) 2 ed. (Herder, St. Louis), p. 165.

[2]) "Mental Life of two Macacus Rhesus Monkeys in captivity," Amer Journal of Psychology, XIII., 1902.

Thorndike's method to monkeys, and with the same result. There was not even the semblance of thought to be noticed; less adapted methods were not replaced by more improved ones; the monkeys did not experiment, did not know how to make use of favorable circumstances to obtain a definite end; the female utterly failed to learn by imitating the male. All was wild and restless activity without reflection.

The same conclusion is reached by Mr. Hobhouse, who after numerous experiments declares that the highest animals grasp events merely in *concrete* series, so far as they are relevant to immediate practical interests. "Caution, cunning and sagacity of the kind which 'animal stories' are so full do not as a rule imply anything more or less than the "concrete experience,' that we have described." Hobhouse explicitly states that the "world of ideas" or of universals is "the distinctive property of humanity." [1])

Nor can examples like that of "Clever Hans" be accepted as proofs of animal intelligence. It is true that von Osten's famous stallion performed actions that seemed to manifest a degree of intelligence perhaps never recorded of any other animal. But a scientific test of the performances of Clever Hans has shown that they must be explained without appealing to any reasoning faculty. Dr. Stumpf, president of the Psychological Institute of Berlin, writes as follows: [2])

Clever Hans was examined experimentally by Dr. E. von Hornbostel, O. Pfungst, and myself. The horse was at our disposal even in the case of his own-

[1]) Mind in Evolution, p. 281, p. 298.

[2]) *E.* Wasmann, Instinkt und Intelligenz, *3. ed.*, p. 220.

er's absence. The result of our inquiry is as follows: If the solution of a problem is not known to anyone present, Hans is unable to find it. Hence Hans is unable to count, figure, and read himself. Moreover, Hans is unable to solve a problem, if he cannot see the persons who know the solution of the problem.[1]) Hence, Hans depends on optical assistance. But this assistance is, in the present case, of a merely instinctive character. In the course of a long training the horse has become acquainted with the slightest changes of bodily position, accompanying the thoughts and reasoning of his master. Mr. Pfungst, whose observing powers concerning very short impressions of sight have been especially well developed on account of a long laboratory

[1]) The following facts originally published in the weekly edition of the Koelnische Volkszeitung are suggestive:

1. A watch was presented to "clever Hans." *Without conedscending to look at it*, he immediately gave the correct answer by stamping eleven times—it happened to be 11 o'clock. I repeat, the animal did not even glance at the watch.

2. Mr. X, who was among the spectators, wrote an example of arithmetic on a slip of paper in such a way that no one present, not ever the owner of the horse, knew the figures of the problem. The paper was then presented to the horse with the request to paw the solution. The animal started pawing *ad infinitum*.

3. On a certain wall near by fourteen boys were sitting in two rows. Hans was asked by Mr. Schillings how many boys were sitting on the wall. *Without really looking in the direction of the wall and counting*, Hans pawed fourteen times.

4. Another time, a captain of the army gave Hans a very simple problem in addition, but made sure that his owner could not influence the horse. Hans failed completely. Then the owner got hold of him, and lo! Hans solved the problem correctly. (Koeln. Volksz. No. 36, p. 5.)

training, succeeded in analyzing the motions which actually caused the clever answers of Hans. In fact, *he was able by mere motions and without putting any question to make Hans perform anyone of his former exhibitions.* Prof. Stumpf concludes his criticism by stating that the case of Hans is so far from proving the intelligence of animals that it rather proves the contrary. For if not even the training powers and patience of a man like von Osten are capable of eliciting the expression of a single concept from a horse like clever Hans, then, indeed, we are confronted by a first class proof in favor of the old and general opinion that animals are devoid of intelligence.

"The animal's self," as Thorndike himself states, "is not a being 'looking after and before', but a direct practical association of feelings and impulses. So far as experiences come continuously, they may be said to form a continuous mental life, but there is no continuity imposed from within." [1])

This is the reason why animals have never invent-

[1]) At one place (p. 73) Mr. Thorndike has the following very interesting sentence: "Perhaps the entire fact of association in animals is the presence of sense impressions with which are associated by resultant pleasure certain impulses, and that therefore, and therefore only, a certain situation brings forth a certain act." If Mr. Thorndike would take the trouble to study Wasmann's works, he would find that this sentence, correctly understood, has ever been the doctrine of scholastic philosophy. Of course, he will blame that philosophy for not being able to support its statements by experimental facts just as he has furnished them. But is it not strange that the old scholastic philosophers arrived at the same conclusions as Mr. Thorndike, though they merely relied on the simple facts of daily experience?

ed even so simple a tool as the ancestors of the human race employed during the so-called stone-age of the Paleolithic epoch, this the reason why they are incapable of rational language. Parrots may be trained to utter articulate sounds and even entire phrases. In general, there is perhaps no class of animals that could not furnish a great many external signs as a foundation for intellectual intercommunication. But the invention of tools as well as of language implies the knowledge of the universal, which is the "distinctive property of humanity."

CONCLUSION.

Animals, then, do *not possess intelligence in its genuine meaning*. They are mere sense-beings. But this inevitably leads to "the admission of a qualitive difference between the human and animal psyche." For, as we have proved before, the specific actions of man and animal are essentially different from each other. Even "plastic instinct" or "simple intelligence," as others call it, is but a material faculty, intrinsically dependent on the nervous system, whereas the intellect with its true intelligent actions is of an immaterial, a spiritual nature. *Consequently, there is an essential, a qualitative difference between the human and the animal soul.* For, as a being acts, so it is.

Moreover, it is equally plain that *we must reject the supposition* of Wundt and of almost all modern scientists, *that the psychic faculties of man have been evolved from the psychic faculties of the animal.* Such an evolution of "mere association" to "conscious intellectual activity," [1]) of "nature" to "culture," [1]) would be

[1]) Wilhelm Wundt, "Vorlesungen ueber die Menschen

an absolute impossibility, *since matter and sense are essentially inferior to spirit and intellect.* For the origin of our "intellectual and moral faculties" we can only find "an adequate cause in the unseen universe of Spirit." [2])

und Tierseele." Hamburg und Leipzig, 1897, 3d ed., p. 419. It is remarkable that Wundt has arrived at the same conclusions concerning the "intelligence of animals" as Thorndike. Wundt even considers it as very improbable that some species or individuals of the present animal kingdom will ever pass the limit separating sense and intelligence; on the other hand, he assumes, as we have stated, that the human species in the course of its evolution has actually taken that important step!

[2]) Alfred Russell Wallace, "Darwinism," Humboldt ed., Part II., p. 322.

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